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Volume 127

ENGINEERING AND MINING JOURNAL

Number 5

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New York, February 2, 1929

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By CARLTON D. HULIN

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"Economical and Efficient Housing for Hot and Cold Climates"

By H. E. CLEMENT AND JAMES GOVAN

A large amount of information, hitherto unavailable, of great value to mining companies with housing problems.

"What Has Happened to the Non-Ferrous Metallurgical Industry of Great Britain, and What Can Be Done About It?"

By WILLIAM CULLEN

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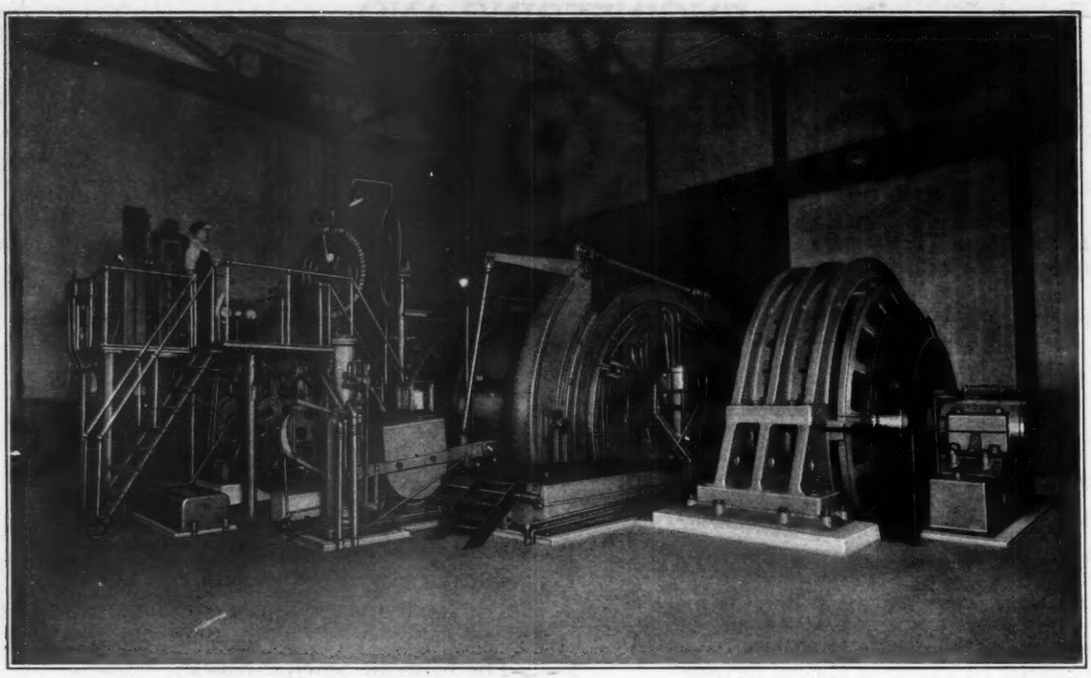

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VOLUME 127 — *New York, February 2, 1929* — NUMBER 5

Unemployment—The Result of Progress or a Sign of Decay?

THIRTY YEARS AGO the first president of the American Economic Association traced a connection between unemployment and an industrial condition responsible for an irregular production of wealth. This condition, he opined, would continue until a return was made to hand tools and to "the petty neighborhood production of a former age." The logic of his conclusion is still accepted in many countries today. A few years later a serious suggestion was made to segregate the unemployed, and "let them produce for their own needs."

These illustrations, indicating indirectly the progress that has been made in the method of attacking an economic problem that might have resulted seriously if so shallow a philosophy had persisted, were used by Mr. Sam Lewisohn, of the Miami Copper Company, in the introductory remarks of an address recently delivered before the American Association of Labor Legislation at Chicago. New conceptions have been evolved in quick succession. In recent years the alleged baneful influence of mechanization has again been stressed, and a moderate amount of attention has also been given to the reasons for seasonal unemployment and cyclical unemployment. As Mr. Lewisohn points out, an excess of supply over demand in the labor market may be due to good management, which creates a condition that may be termed technological unemployment; or it may be due to bad management, which creates seasonal unemployment. Thus the trouble may be the result of progress, or a sign of decay.

This statement clarifies the problem and facilitates analysis, suggesting the direction in which research should be considered; but breadth of treatment is essential to a successful solution, and it is the duty of all branches of industry to co-operate in the adjustment of so important a factor in the attainment of national prosperity and contentment. Who is responsible for the solution of the problem? Mr. Lewisohn supplies the answer:

> The financier must exert a sane but firm control in the prevention of unjustifiable expansion, using his influence generally to the end that business trends be steady and logical. Production executives and sales managers must co-operate in regulating operations so that seasonal unemployment is avoided. The public official can help by adjusting fiscal policies so that the ill effects of industrial depression will be less severe. The economist must use his influence in the promotion of desirable commercial trade policies. The personnel manager's task is to minimize labor turnover by transfer adjustments within the organization. The trade unionist can help, as many have done, if he co-operates with all the other elements and insists on the maintenance of stabilized and satisfactory conditions.

Whatever the cause of unemployment, the duty of civilized society is to keep the problem in the forefront of any program that has for its purpose the encouragement of a healthy progress in national conditions and international relations. As Mr. Lewisohn aptly and correctly maintains, unemployment is an obvious social indecency. The correction of the condition involves careful analysis and adequate attention to the fundamental principles underlying a satisfactory plan for the maintenance of economic hygiene.

The Ambitious Program of the Bureau of Mines

BY ITS metallurgical studies the U. S. Bureau of Mines has long been of material assistance to the mining industry, especially to the small operator. The needs of the mining engineer, outside of the coal industry and aside from the subject of safety, have received considerably less attention. To remedy this deficiency, if thus it may be termed, a program was drawn up some time ago by Mr. Scott Turner, the Bureau's Director. In it is involved the production of a series of papers on the application of the various mining methods in metal mines of the country. These papers, issued as "Information Circulars," will be prepared by the mining company executives themselves, acting in the capacity of consulting engineers to the Bureau. They will direct attention principally to costs. The first, recently released, is entitled "Method and Cost of Mining Magnetite in the Mineville District, New York." It will be found to commence on page 190 of this issue. The author-consultant is Mr. A. M. Cummings, general superintendent for Witherbee, Sherman & Company. Later, as Mr. Charles W. Wright, who is in charge of this part of the Bureau's program, stated in the Jan. 26 issue, these papers will be made the basis of studies on specific phases of mining. The primary object of the Bureau is to help operators to reduce their costs.

Such studies will serve to make mining more efficient. In the aggregate they will make possible an important saving, although one that can never be determined. By investigations of this sort the Bureau continues to justify its existence and its annual requests for funds. In the face of this program, however, the Director of the Budget has blithely done his utmost to make it ineffective by pruning the appropriation recommended by Mr. Turner for the coming fiscal year. Indeed, at the moment, it is impossible to say how far the Bureau of Mines' work is to be crippled by lack of funds. Congress possesses the only remedy for the situation. It should ignore the reduction made by the Bureau of the Budget and grant the appropriation originally requested.

Is the American Taxpayer's Burden Too Great?

TAXES collected by the federal, state, and local governments in the United States during the fiscal year ended in 1927, the last for which figures are available, totaled $9,074,000,000 —the largest amount for any one year up to that time, according to a report of the tax division of the National Industrial Conference Board. And, one may be sure, for 1928 the total was still higher.

Eldorado, its storied golden dinnerware to the contrary notwithstanding, can have little fascination for the modern American youth, bred in the midst of such stupendous sums and fed them daily through the medium of the press. Nine billions of dollars! What a prodigious sound it has! And, to the thrifty citizen, what an ominous one! His first impulse must be to cry "STOP!"

But first impulses are not always correct ones. If the imagination is staggered, the mind at least should keep its balance. Examined carefully and without that reverence for mere bulk or size which seems to be a distinguishing characteristic of so many moderns, $9,000,000,000, large sum though it be, cannot seem disproportionate. Distributed among the 120,000,000 inhabitants of the country, the average amounts to less than $80 per person. For this sum, education, protection of property from fire and theft, roads, bridges, parks, water in most communities, and innumerable other facilities and services, too diverse in character to enumerate, are provided.

Unfortunately, the efficiency of an administration is nearly always measured by its ability to keep expenses down to a minimum, and, as a result, much-needed funds are often denied to deserving causes, particularly when the number of voters directly interested in those causes is small.

In our own field, the mining company with large ore reserves and sufficient capital, which is deterred, by a foolish desire for thrift, from buying modern and efficient machinery, pays the penalty in decreased dividends. So it is also in the larger affairs of the nation. If the people are not willing to finance good and adequate government, they suffer for their miserliness by a decline in prosperity. What is needed is not a reduction in taxes but more care and selection in the expenditure of the proceeds. The voting public should be educated to realize that an administration that cuts the tax bill is not necessarily a good administration.

Money is created only as a measure of value, not as the value itself.

Emphasizing the Value of Dependable Equipment

WITH copper mining on a stable basis, thanks to low stocks and firm prices that prevail, producers should be able to look forward to a long period of steady operation. Therefore, each should consider if his plant is properly equipped for a continuous run. With prices steady and with a uniform grade of ore, profits will depend directly on production costs, and these, in turn, to a large extent upon tonnage handled. Low costs are to be attained only with equipment that will run with few delays over a long period of time.

Efforts to mill large tonnages are at times defeated by the failure of equipment to respond to the demands made upon it. Nowhere more quickly than in crushing and grinding will poor design and too-cheap construction of machinery be revealed. Subjecting a grinding mill to heavy duty is sure to make manifest its qualities, whether good or poor. So the operator will do well to consider to what extent he can rely upon his plant for steady and efficient performance. If after such study it appears that replacements or additions are advisable, he should pay due attention to the factor of dependability in selecting the equipment.

Possibilities for France in Mineral Development

AS THE NATURAL RESOURCES of Europe and North America become more and more completely exploited, mining engineers must give increasing thought to the continents whose resources are less developed; of chief present interest are, of course, Africa and South America. President-Elect Hoover has brought South America into the popular limelight by his recent tour; though Chile, Peru, and Bolivia, at least, have been recognized as mining districts for years. The Rand gold deposits in South Africa have been superseded in popular interest recently by the copper developments in central Africa. In the mining operations of all of these districts one does not ordinarily think of France as being particularly concerned, so it was enlightening to hear Dr. Julius Klein, chief of the Bureau of Foreign and Domestic Commerce in Washington, point out, in a talk given in New York recently, the increasing attention that France is giving to relations with Africa and South America.

The large holdings of France in Africa are not generally appreciated. Of the 11,600,000 square miles embraced in that continent, she owns or has authority over 5,300,000, or most of the western half, except to the south. Most of this area is undeveloped, of course. In the north, the phosphate deposits are more productive than any other such deposits in the world; and iron, antimony, lead, and zinc have been produced to some extent, but a vast potential mineral area is awaiting investigation, which, if successful, will mean an increased share by France in the mining industry of the world.

As to French expansion in South America, perhaps not enough importance has been given to a recent event on which Dr. Klein dwelt. A weekly eight-day mail service has recently been established between Buenos Aires and Paris, by the Latecoere company in France and the Condor company in Brazil. First the coast-line of Brazil is followed, which extends for over 2,000 miles directly towards France; then an 1,800-mile water hop by fast steamship; then another 2,000 miles or so, still in a straight line by air across French territory in northern Africa; and thence to Paris. So rapid a means of communication will undoubtedly stimulate trade between France and South America, and may ultimately result in the diversion of much French capital to the development of the southern continent's mineral resources. Such

European interest would be welcomed as a relief from threatened financial dominance by the United States, as is suggested in an interesting article by Mr. L. L. Bernard in the December *North American Review* entitled "Why South Americans Fear Us."

France, then, bids fair to become of increasing importance in the development of mineral resources in Africa and perhaps in South America, though such development is not likely to be rapid, nor an important challenge to the United States or the British Empire for some time to come.

Utah Takes the Lead in Advertising the Industry

PERHAPS no better analysis setting forth the economic value of a single industry to a state has appeared than that recently issued in booklet form by the Chamber of Commerce of Salt Lake City under the title "What Mining Means to Utah." The major part of the booklet consists of a series of short articles, each of which was prepared by the manager of one of the leading mining or smelting companies operating in the Salt Lake valley. These articles summarize the economic importance of individual companies to the state and to the districts in which the operations of the respective companies are situated.

Consolidated statistics are presented, including such significant information as: the mining industry of Utah disburses $85,000,000 annually for wages, freight, and supplies; the payroll of the industry is one-third of the total of the payrolls of the state; supplies purchased for company use average $50,000 a day; and freight tonnage of the industry is 80 per cent of the total originated by the railroads of the state. Employees of the industry, and those directly dependent on it, spend annually $15,575,000 for food, $6,400,000 for rent and homes, and $4,750,000 for clothing.

Inestimable benefit will undoubtedly accrue to Utah, and to the mining industry of the state, particularly, as a result of the distribution of the booklet. This is predicted inasmuch as "What Mining Means to Utah," although practically a pioneer effort in the industry, is exceptional advertising—something that mining needs greatly. Those responsible for the issuance of the booklet are to be commended. Similar action by agencies in other mining states would be of increasing advantage to the industry.

How Many Prospects Become Producing Mines?

HOW many prospects become mines? Various estimates have appeared, based on the experience of exploration companies or mining engineers, but actual statistics are not available. They are hard to get, and prospectors do not usually keep a log of their activities.

In the December bulletin of the Institution of Mining and Metallurgy, Mr. T. G. Trevor, with a background of forty years' experience in Africa, part as a government inspector of mines, states that the exploration-prospecting of about 464 properties in ten years led to the closing down of 144 and the development of 323. Of these latter, 122 were subsequently abandoned, and 201 ultimately arrived at the producing stage. Of the 201, about 131 shut down and 70 survived. Of the 70, 20 have proved successful; two are probably successful; six are of doubtful success and 42 are failures. Therefore, of the 464 original ventures, 22 have been successful, or about 4.7 per cent. Mr. Trevor says that the prospecting was done in approved areas or those known to contain minerals. He thus establishes the ratio of 25 to 1. He comments on the inadequacy of the return to the prospector.

The element of chance introduces spice into daily life. In some countries a large proportion of the population lives in a condition of perpetual hope, in return for a modest expenditure per week for a lottery ticket. Some one must win and some one does win, and the thought or the happening brings temporary or permanent relief from what is usually a major worry of daily life.

In the early days of a gold or diamond rush so many genuine prizes were to be found and so many wildcats were available for sale at a profit that the lottery of prospecting and supporting prospectors was equal to the needs of the situation. But when the rush ceases, and business caution takes the place of speculative optimism, prospecting becomes a blind-alley occupation, attractive only to those who cannot abandon the life they love.

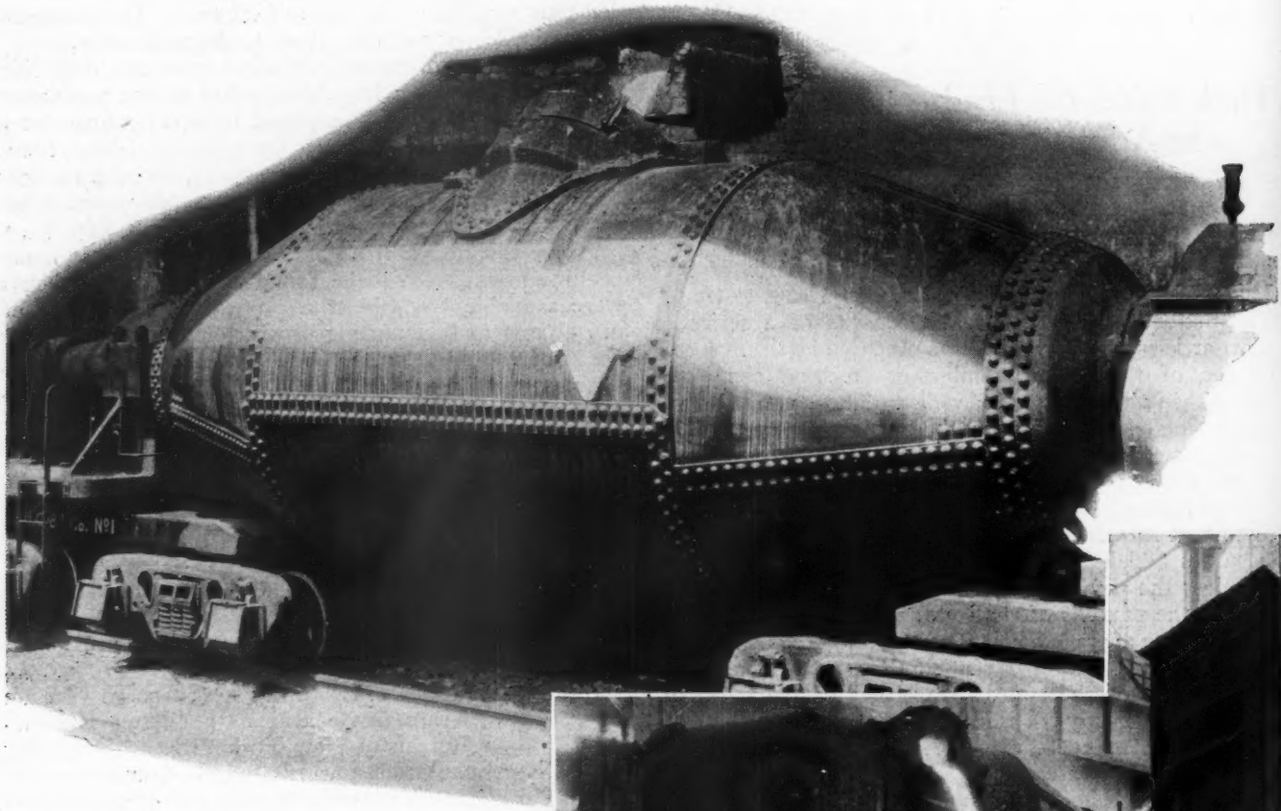
Better Business Bureau Points With Pride

EMINENTLY fitting was George Graham Rice's tirade against the Better Business Bureau of New York City, in the closing day of his trial. His last words before sentence constituted a savage attack upon the Bureau and others responsible for his predicament. Inasmuch as one may be judged by his enemies as well as by his friends, the Better Business Bureau is to be congratulated on the ire that it aroused in the breast of Mr. Rice.

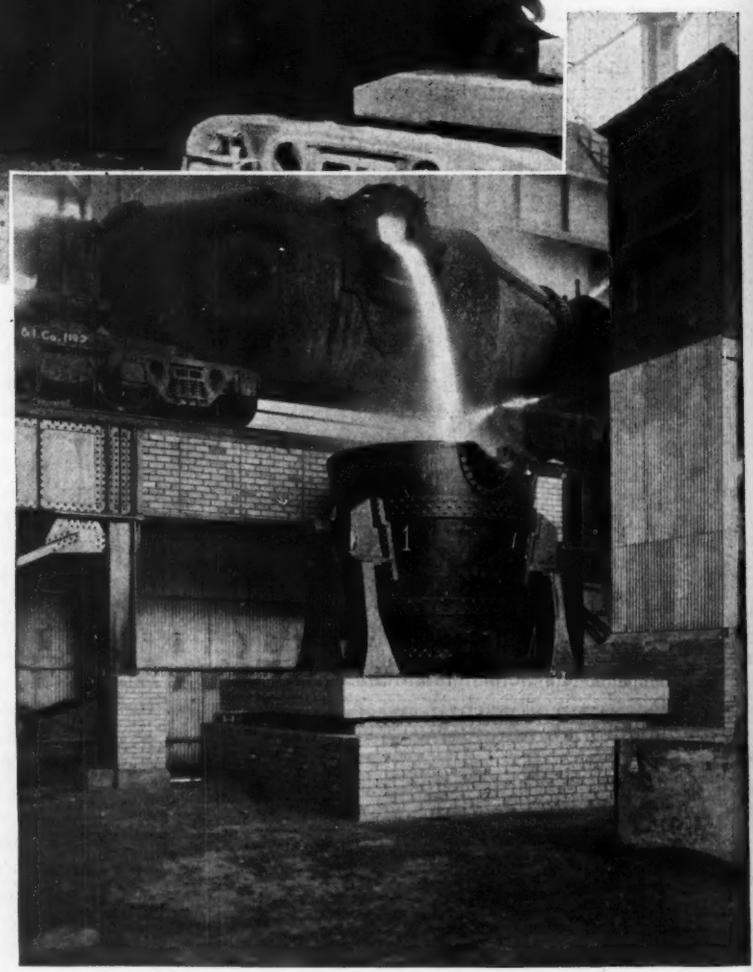
With pardonable pride, the Bureau has recently issued an eight-page pamphlet dealing with the career of this leader among the tipster-sheet stock swindlers, which makes interesting reading and which should have a wide circulation. That it will be read widely not only by those who find themselves, willy-nilly, on sucker lists, but also that it will convey a warning to other crooks who are out to bilk the unsuspecting public by the sale of fraudulent mining shares is earnestly to be desired. Copies of the bulletin can be secured from the Better Business Bureau of New York City, 280 Broadway, an organization that is glad to give such information as it may have available in regard to individuals and promotions the integrity of which the public may question. Or seekers for the truth may address the National Better Business Bureau, of 383 Madison Avenue, New York City, or any one of the local bureaus established in many cities. These bureaus are supported by the reputable business concerns of the country who believe that money for investment should come to them instead of to the crooked promoter. *Engineering and Mining Journal* concurs.

Long-Distance Transportation of

Recent innovation in metallurgical practice involves transport, over ten miles of special track (Baltimore & Ohio Railroad), of molten iron from the blast furnaces of the Hamilton Iron & Coke Company, at Hamilton, Ohio, to the east works of the American Rolling Mill Company, at Middletown, Ohio



Above, the giant ladle receiving its load of 150 tons of molten metal. Insulation is so thorough that "freezing" cannot occur within 48 hours. The ladle and its load weigh 325 tons.



At right, pouring the transported metal from the railroad ladle to the plant ladle

Molten Metal

Above, the special trestle bridge near the Armco plant at Middletown, with its load of ladle and locomotive

At left, emptying the contents of the plant ladle into the open-hearth furnace at Middletown

MINING MAGNETITE

in the New York

Mineville District

The Method and Costs

By A. M. CUMMINGS

Consulting Engineer, U. S. Bureau of Mines

EACH mining district presents different problems as to methods of ore extraction and underground support, which are dependent upon the type of ore deposit and the character of the inclosing rock. Mining costs, however, depend largely upon the efficiency with which the methods employed underground are applied, as well as upon the selection of the method best adapted to the physical conditions. The purpose of this paper is to present to the operator in other districts a detailed description of the mining methods used and results obtained in the exploitation of the bedded magnetite deposits of the Mineville district, New York. The town of Mineville is situated in the Adirondacks, 5 miles west of Port Henry on Lake Champlain. Records show that iron ore was produced in the Mineville district during the American Revolution. As far back as 1849 Witherbee, Sherman & Company, owners of the present mines, started operations which have been continuous with but small periods of suspension up to the present. The relative importance of the district is indicated by its vast production, which has amounted to approximately 45,000,000 tons. As shown on the Adirondack sheet of the geological map of New York State, the Mineville district is situated within the area of Adirondack gneisses and Grenville limestone. This area is penetrated by small masses of an intrusive rock (gabbro), and the principal orebodies are adjacent to one of these masses. Both to the north

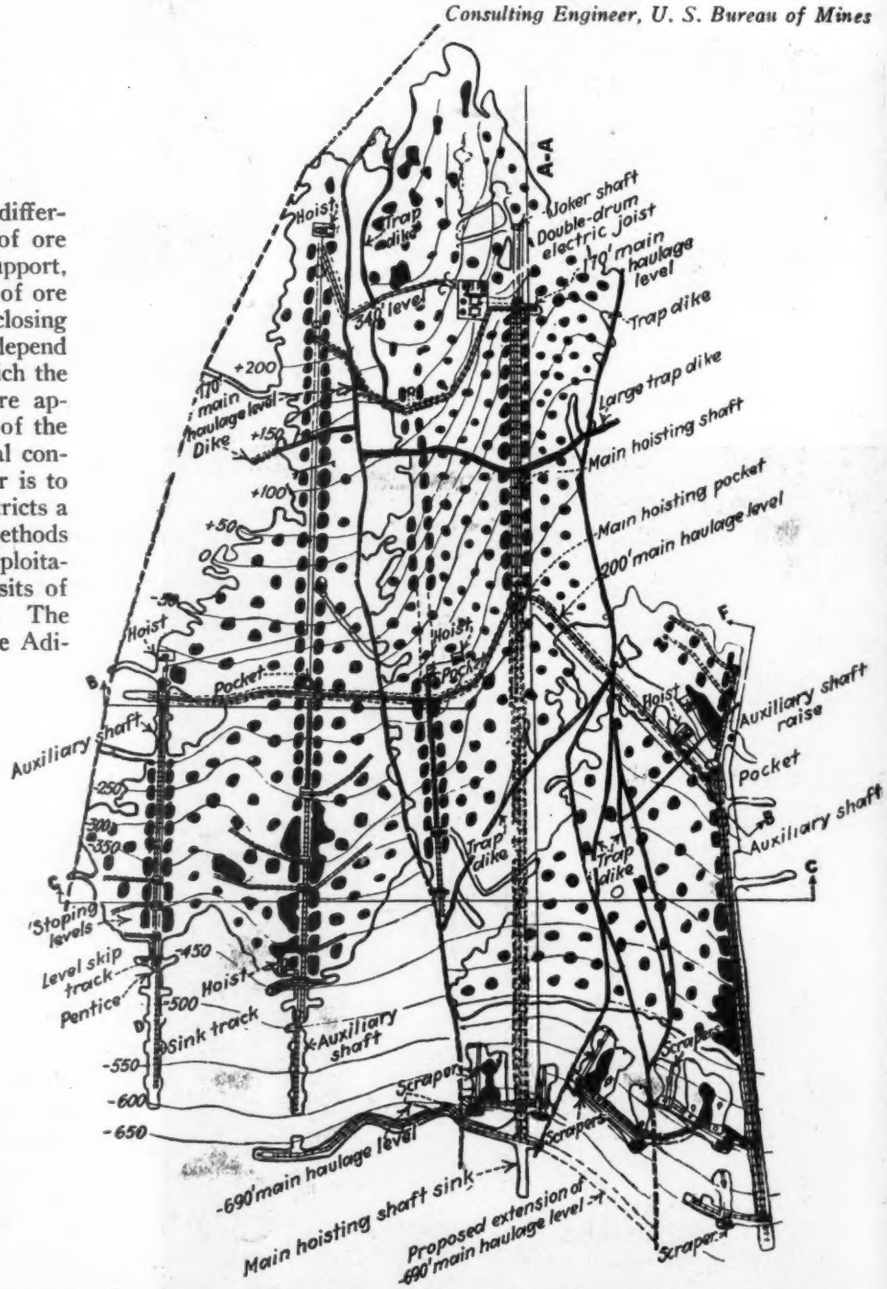


Fig. 1—Plan of Old Bed mine, showing mine contour lines, transportation system, and lines of sections. The broken line on the left-hand side represents the line along which the orebody is faulted 150 ft. to the Miller Pit mine.

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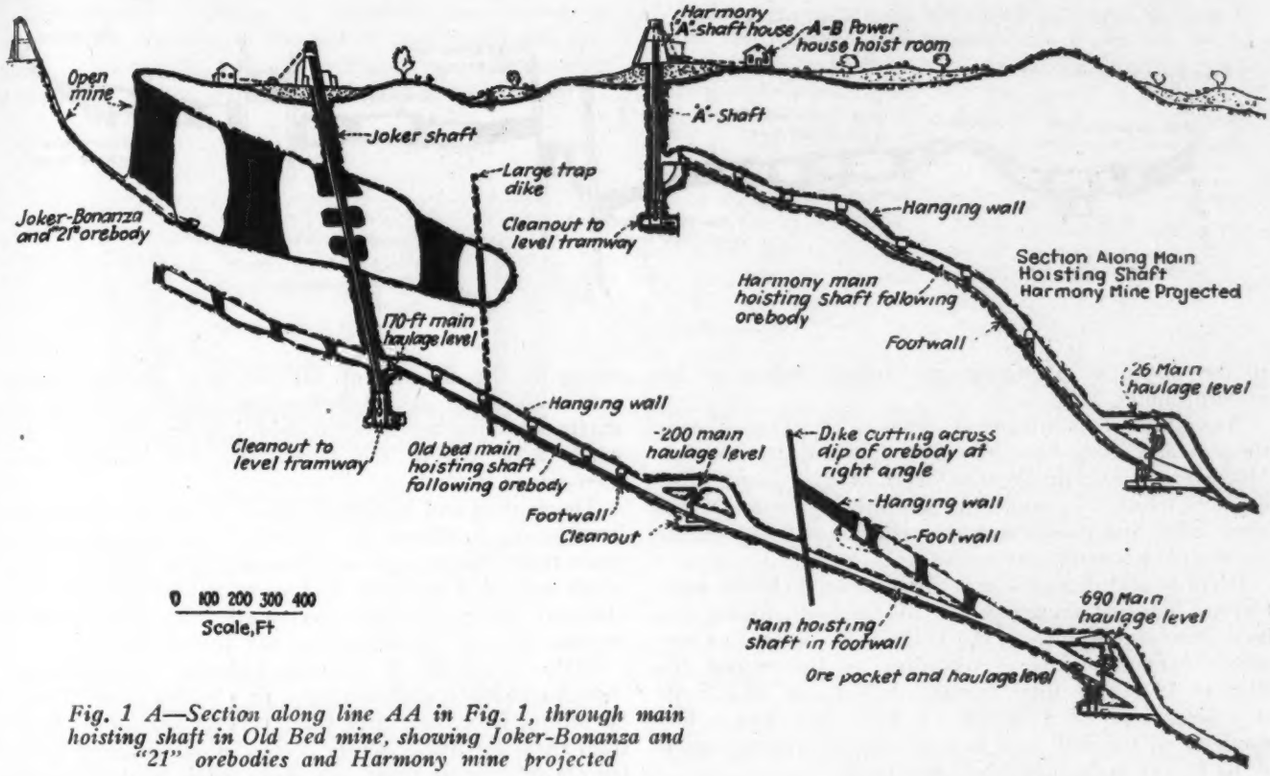


Fig. 1 A—Section along line AA in Fig. 1, through main hoisting shaft in Old Bed mine, showing Joker-Bonanza and "21" orebodies and Harmony mine projected

and west is an extensive mass of gabbro which measures 100 miles across in an east and west direction. The gneissoid rocks are classified as Pre-Cambrian, and the occurrence of limestone would indicate that they are of sedimentary origin. Trap dikes occur, crosscutting the gneissoid rocks as well as the magnetite beds. Faults and much folding are prominently disclosed in the underground workings.

The magnetite deposits occur interstratified in the gneissoid beds, the principal ones dipping to the southwest at angles of 20 to 30 deg. from the horizontal. They extend from several hundred to several thousand feet in depth and have corresponding lateral dimensions. In thickness they vary from 3 to 40 ft., the average being 10 ft. of workable ore.

At the Old Bed mine an important magnetite mass which occurred near the surface averaged over 200 ft. in thickness and is known as the Joker-Bonanza and Twenty-One orebody. This has been mined out except for the pillars left as supports. It is shown in Fig. 1*A*, a section through the main hoisting shaft of the Old Bed mine. In places there is no definite division between ore and rock, and magnetite is found disseminated through the gneissoid beds in scattered grains, locally in sufficient quantity to make ore. In other places, and in particular along the footwall, a sharp division line separates the ore from the rock.

Ore is mined running as low as 25 per cent iron and is mixed with richer ores running as high as 69 per cent to produce an average grade of ore mined of 42 per cent. This crude ore is concentrated by magnetic methods to produce a shipping product which will average 68 per cent in iron.

The beds have been disturbed by several major and minor faults and have been displaced from 15 to 150 ft.; these faults, together with the folding, have added greatly

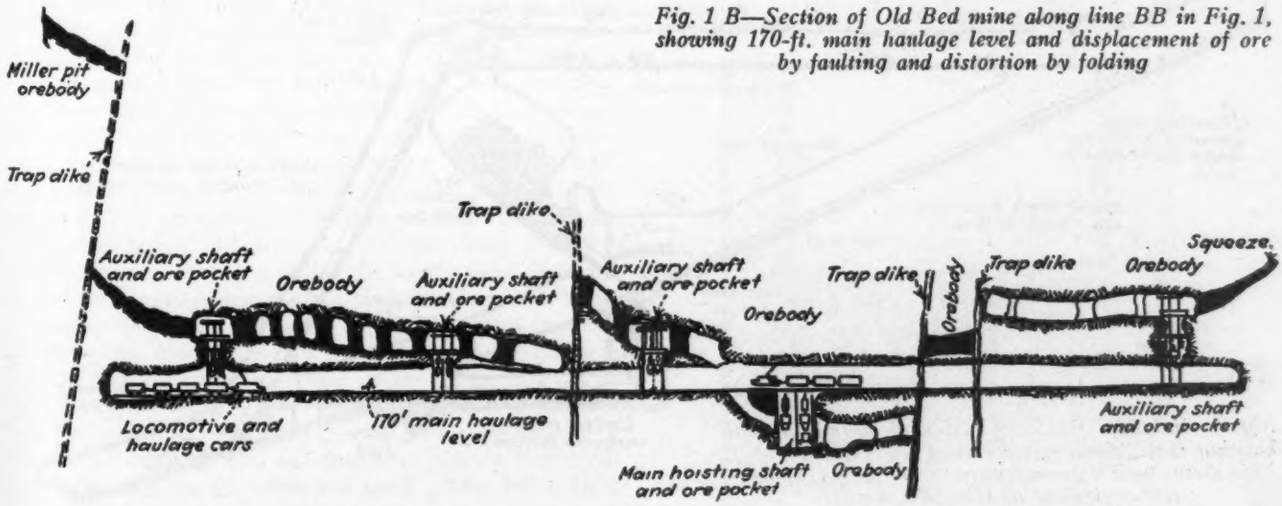
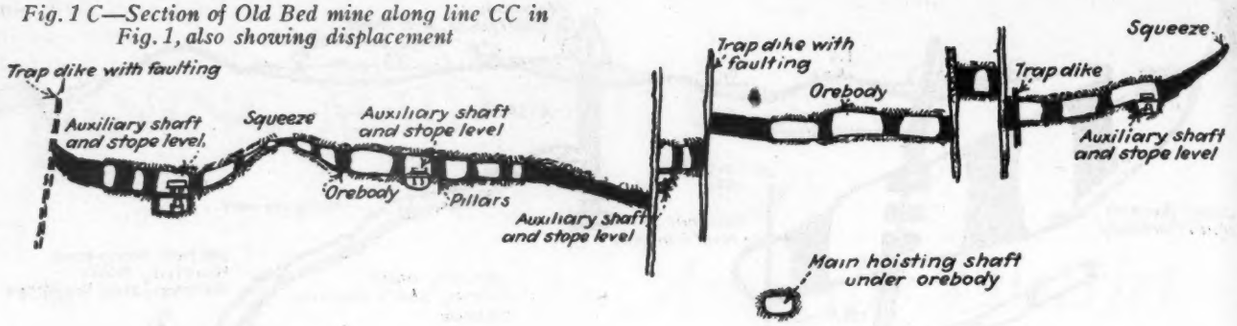


Fig. 1 B—Section of Old Bed mine along line BB in Fig. 1, showing 170-ft. main haulage level and displacement of ore by faulting and distortion by folding

Fig. 1 C—Section of Old Bed mine along line CC in Fig. 1, also showing displacement



to the difficulty of mining and transportation of ore underground.

As certain of the magnetite deposits are exposed along the surface, they have not been difficult to discover. However, to explore them at depth, and to locate other deposits which are now being worked, magnetic surveys were made and diamond-drill explorations based on the surveys were carried out extensively.

Records and diamond-drill cores were carefully kept. Over a hundred thousand feet of diamond drilling has been done on contract on the Witherbee, Sherman Company's property alone. According to the record for 1918 to 1919, the total footage drilled was 31,725 ft. at a total cost of $124,578, or $3.92 per foot. The diameter of the drill core is 1 in., and an average speed of 10 ft. per eight-hour shift was made.

Geophysical methods based on electrical induction have been tried out this year by the physicists of the U. S. Bureau of Mines. Their results were found to check closely with those of the diamond-drill records.

Mining was naturally started at the surface and then, owing to the flatness of the deposits, inclined shafts were sunk along the footwall of the orebody. From the shafts, working levels were driven in the ore, and the whole area, except the pillars left for support, was then mined.

The faulted and folded condition of the orebody made it necessary to change the course of the inclines, which made track maintenance and hoisting very difficult. The result was that as soon as any appreciable depth was obtained, the output was decreased, with an attendant increase in cost of production per ton of ore.

Early methods of mining included hand-drilling, shoveling, and hand-tramming with wheelbarrows. These operations have been largely replaced by the use of hand tram cars, air drills, scrapers, mechanical loaders, electric shovels, larger mine cars, and electric haulage equipment, in keeping with the general mining practice throughout the United States. The mining method, the open-stope system with pillar support, has remained the same, and it is doubtful if any other system would give as good results under the conditions.

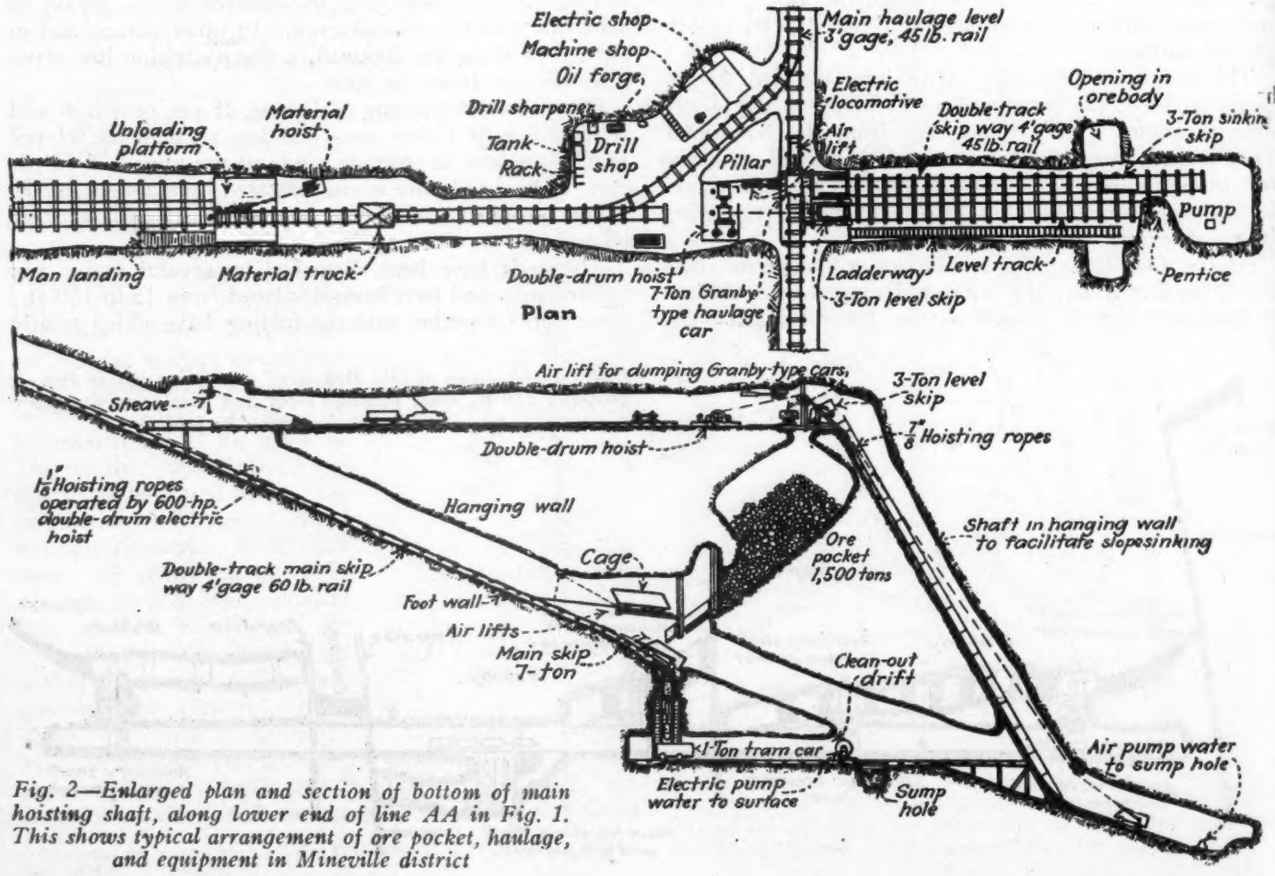


Fig. 2—Enlarged plan and section of bottom of main hoisting shaft, along lower end of line AA in Fig. 1. This shows typical arrangement of ore pocket, haulage, and equipment in Mineville district

Development is simple and relatively inexpensive, as most of the work is in the ore or just under the orebody. This is clearly shown in Figs. 1 and 1*B*, showing a plan and sections of the Old Bed mine. Different

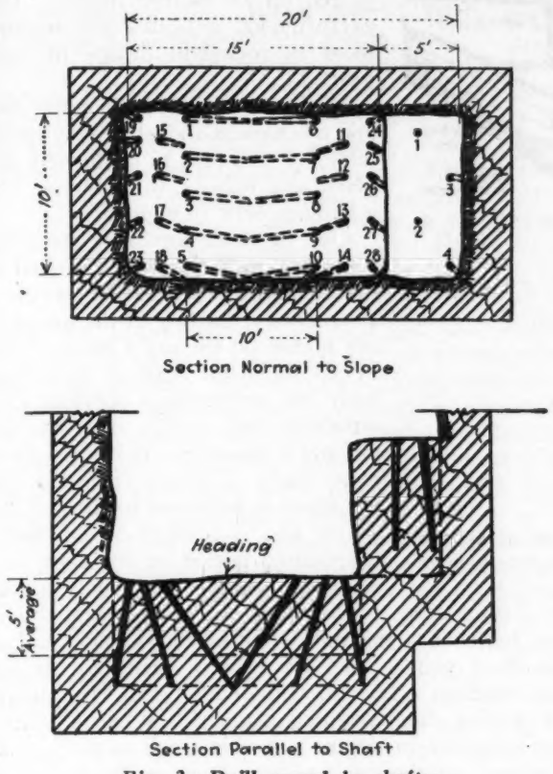


Fig. 3—Drill round in shafts

scales have been used in the figures to show some of the important conditions more clearly. The following description of the development system will be confined to the Old Bed mine. In the section, Fig. 1*A*, the main shaft of the Harmony mine is shown.

Main Shaft Follows Dip

The main shaft follows the dip of the magnetite bed along the footwall, and pockets and loading chutes are placed either in the orebody above or in the hanging wall (Fig. 2). Part of this shaft, however, is in the footwall for a considerable distance; this was necessitated by the faulted condition of the orebody at almost right angles to the dip. The general practice is to keep the main shaft, as well as the auxiliary shafts along the footwall, cutting into the rock approximately 7 ft., to allow each level to start directly on the footwall of the orebody. The main shaft is generally carried 15 to 20 ft. in cross-section. When the deposit is not thick enough to attain 15 ft. in height, additional rock is cut from the roof. In the rock, and where the orebody is small and the levels are located 75 ft. apart, the shaft is carried 10 by 20 ft.

In main shafts the work is carried along with the regular mining operations and the shaft men are paid by the premium system, which will be described later.

Footage per shift in the 10 by 20 ft. shafts depends on the speed it is necessary to make. Heavy Leyner-type drills with an air pressure of 85 lb. are used, and each drill is operated by one man. One and one-quarter-inch hollow round drill steel, with cross bits having a taper of 14 deg. and ¼ in. difference in gage, is employed, and four changes of steel are used. The holes start at 2¼ in. and bottom at 1½ in. Blasting is done with 40-per cent gelatin powder, which is detonated by the use of double tape fuse on a No. 6 cap. When speed is required, three drills of the heavy Leyner type, mounted on bars and tripods, are used. An average of 5 ft. per shift is made, using the cuts as shown in Fig. 3.

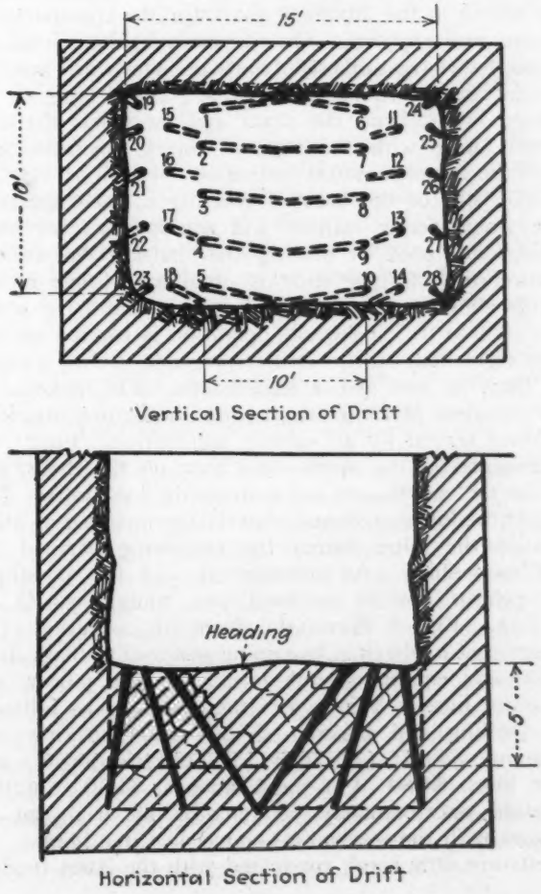
The average cost per foot for sinking, hoisting material to the main shaft, and equipping with tracks, air, and water line is $32.30, made up as follows: (1) Drilling and blasting, $13.10; (2) mucking and hoisting, $12.40; (3) track, air, and water lines, $4; and (4) miscellaneous, $2.80. One hundred and fifty pounds of powder is used per round. The day is divided into three eight-hour shifts. Drilling is done on one eight-hour shift, and the cleaning by hand on the two remaining shifts.

The company's experience is that with the present-day drilling equipment the whole problem in making speed in shaft sinking is that of the removal of the material after it is broken.

In the orebody the shafts are worked in the same way as are the auxiliary shafts. Sinking is done by stoping out the ore with light hammer drills mounted on tripods (see Figs. 5 and 6). The shafts are timbered only at the loading stations.

Extending from the main shaft, at intervals of 1,000 to 1,500 ft. along the dip, are the main haulage levels. These are 15 by 10 ft. in dimensions, with enlargements for switches and ore pockets, and are driven in the footwall on a contour which will keep them near the orebody and require the minimum amount of rock work to con-

Fig. 4—Drill round in drifts



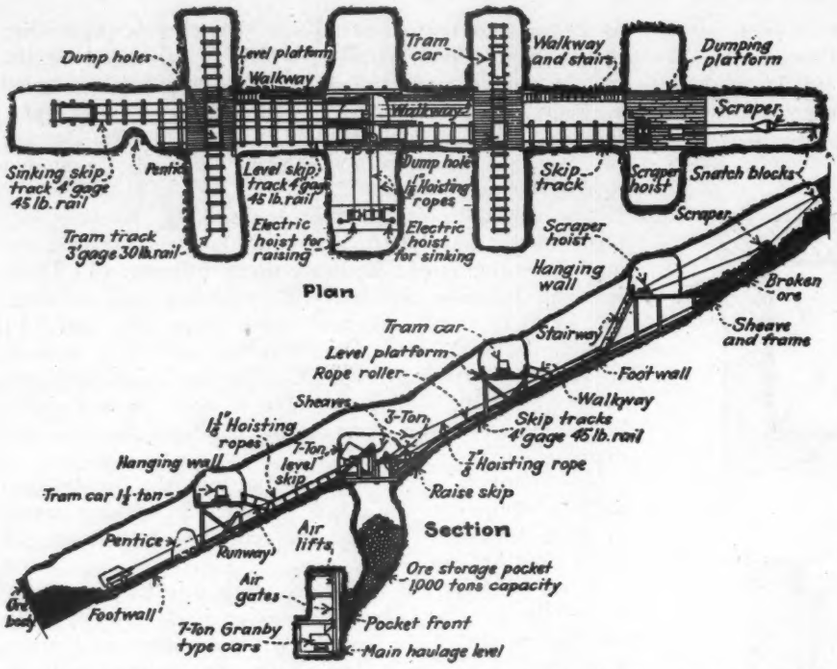


Fig. 5—Enlarged plan and section of auxiliary shaft, showing typical method of sinking and raising in orebody, and of hoisting and lowering ore to main haulage level

nect the faulted area. From the levels, crosscuts and raises are driven to the orebody in each faulted area, and at intervals in the unfaulted area where a single auxiliary shaft would make the length of tramming too great. The raises are driven to permit the introduction of small ore pockets; the crosscuts are driven to give easy access to the auxiliary shaft for the transportation of men and supplies. On the main haulage level the ore pockets have timbered fronts on which are installed mechanically operated chute doors. The driving of the haulage levels from the main and auxiliary shafts is carried along with the regular mining operation and under the same premium system.

Two drills of the heavy Leyner type, each operating on a single screw column and equipped as for shaft sinking, are used in driving the drifts. An average advance of 5 ft. per shift is obtained. Some of the records show an advance of 7 ft. per round for a distance of 600 ft. The whole operation is carried on in a single eight-hour shift. Drillers are able to drill a round and blast in five and a half hours. The material is then removed in three hours with mechanical mucking machines served by an electric locomotive. Four men are engaged in the work—two men on the drills, one man on the shovel, and one man on the locomotive. The men on the locomotive and shovel are employed at other parts of the mine during the remaining part of the eight-hour shift. An average of 125 lb. of 40-per cent gelatin powder is used per round, or 25 lb. per foot. Fig. 4 shows the form of cut used. The average cost of driving, tramming material to main shaft pocket, and equipping with tracks, electric power, air, and water lines is $15.46 per foot, made up as follows: (1) Drilling and blasting, $7.66; (2) mucking and tramming, $4.60; (3) track, air, electric power, and water lines, $1.80; (4) miscellaneous, $1.40. In this operation approximately 50 tons of material can be removed with the mechanical shovel in three hours.

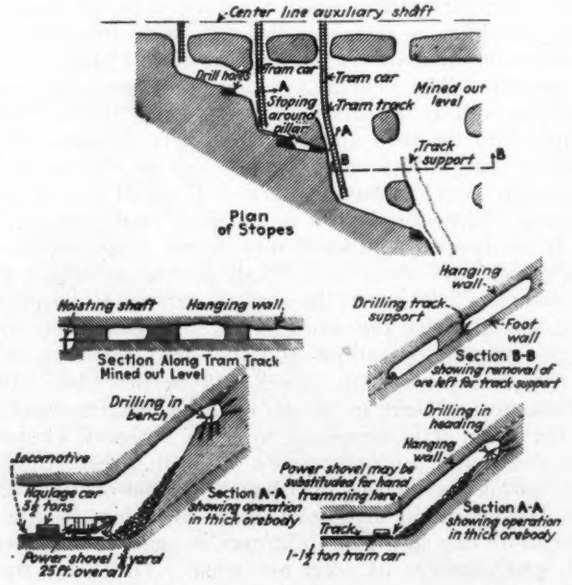
Tests are now being conducted with the latest models of heavy Leyner-type drills offered by several manufacturers. Some of these drills have proved that they can make at least 25 per cent greater drilling speed than the older models now in general use in these mines. Their performance indicates the improvement in rock-drill design in recent years.

With the use of faster cutter drills and mechanical shovels it may be possible for two men to completely drill, blast, and remove the material from a haulage drift in eight hours.

One or more auxiliary shafts are located in each faulted area, and are driven both up and down the dip of the orebody, starting at the top of the ore pocket on the main haulage level. When the main shaft is in the orebody, the extension is operated as an auxiliary shaft until a new station is cut and a connection is made with the main shaft. The ore from the stoping levels is delivered to the auxiliary shafts and is hoisted or lowered to the loading pocket on the main haulage level or to the main shaft pockets.

Auxiliary shafts are carried 7 ft. in the footwall to the full height of the orebody and are made 20 ft. wide. They are sunk or raised by carrying breast headings 7 ft. high at the hanging wall and underhand stoping the remaining material. When a shaft is being extended in depth, a double track is used. One car hoists from the levels and the other car hoists directly from the sink. This procedure is continued until the distance from the sink to the ore pocket on the haulage level becomes approximately 800 ft., at which point a small ore pocket is installed to discharge the material into the car which is hauling from the levels. An ore or rock pentice is left back of the operating track to protect the men working in the sinks.

Fig. 6—Plan and sections showing method of stoping and loading in varying thicknesses of orebody, Mineville district



In advancing the auxiliary shafts up the dip of the orebody the material is removed by scrapers which carry the material directly onto a platform. When a carload of material has been collected on the platform, it is pulled into a skip car, as soon as a car can be spared from the levels without causing delay. Fig. 5 illustrates the method of advancing these shafts.

Work which is charged to the development account includes the sinking and cutting out for ore pockets along the main haulage shaft and main haulage level, and the exploration sinks and drifts in the auxiliary shafts. All the work in connection with sinking, cutting out levels, and installing tracks, platforms, and air, water, and power lines along auxiliary shafts is charged to the regular mining account.

The Present Mining Method

The plan and sections of the Old Bed mine workings (Figs. 1, 1*B* and 1*C*) show the general system of mining in the district. Starting from the auxiliary shafts, stoping levels are advanced at intervals of from 30 to 100 ft., depending upon the dip, width, and faulted or folded conditions of the orebody. Figs. 6 and 7 show the methods employed, with variations which depend upon the condition of the orebody.

Upper levels are kept well in advance of those below, so as to get the greatest benefit from gravity and the minimum amount of heading work. Where the bed is 15 ft. thick, headings are continued at a height of 7 ft. until a break is made to the upper level. These headings and the upper levels form a bench from which underhand stoping is done. Fig. 6 shows the method of stoping where the loading is by hand and mechanical shovels. Fig. 7 shows the method of stoping where scrapers are used.

The magnetite breaks very large, and it is necessary to do a great deal of block holing. Small holes are drilled in the slabs, which are broken up by the use of portions of a stick of powder.

All the work in the auxiliary shafts, including the shaft sinking and the small amount of drifting necessary, is performed with mounted and unmounted light hammer drills, operated either wet or dry as the conditions may require. The light hammer drills are mounted only when used in the headings and drifts. For the underhand work they are operated by hand. In stoping one ton of ore, an average of 0.779 lb. of powder is used. Twenty-five-per cent powder is used in all auxiliary shaft work. Forty-per cent gelatin is used in the rock work in the main shaft and the main haulage level. Approximately 75 per cent of the 40-per cent grade and 25 per cent of the 25-per cent grade of powder is used. The cost of the 25-per cent powder for the year averaged $0.1375 per pound and of the 40-per cent powder, $0.1525 per pound.

The mine is supported entirely by pillars of ore, which vary from 20 to 60 ft. in diameter, depending upon the height and character of the roof. These are spaced about 50 ft. from center to center. Between the pillars the roof is arched to prevent slabbing off of the ore or rock. To date, even on the lowest levels the pillars have shown no signs of pressure and there has been no breaking down of the roof in any part of the mine. The pillars represent 25 per cent of the magnetite beds in the mined sections; later it will be possible to recover this ore by mining the pillars at the boundaries of the mine or body and retreating toward the shafts, allowing the ground to cave. In certain of the upper workings, where large pillars have been left, some of the pillars have been mined by first cutting them free from the roof and then blasting them down with underhand holes.

Adjacent to the auxiliary and main shafts, pillars of ore are left for a width of 20 ft. on each side, through which a small drift is driven at each stoping level. These pillars are left not only to give support to the shaft but for protection against mining in the stopes.

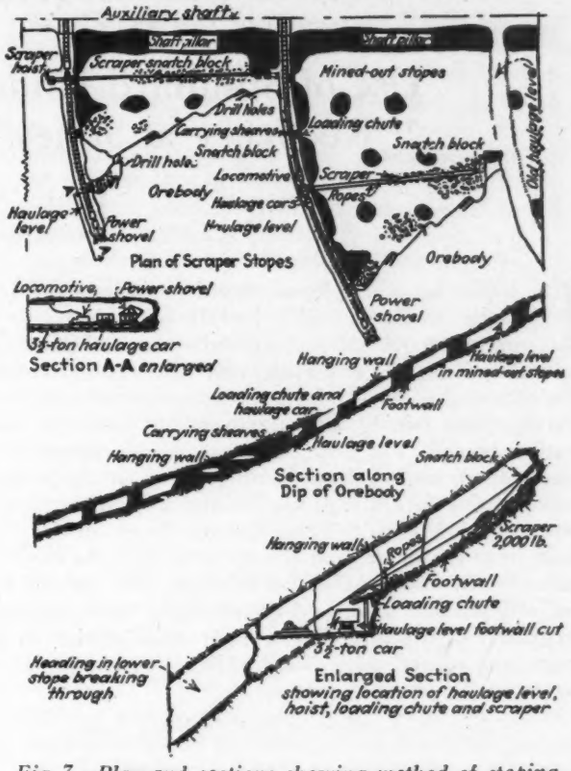


Fig. 7—Plan and sections showing method of stoping and loading with scrapers, Mineville district

Fault planes occur which sometimes displace the beds a hundred feet or more, locally making additional support necessary. The displacement of the magnetite beds prevents a regular development of the mine, and additional shafts and connections with the main haulage levels have often been made necessary thereby.

(To be concluded)

Total U. S. Mineral Production Decrease 2 per Cent in 1928

THE total value of mineral production in the United States in 1928 was approximately $5,400,000,000, as estimated by the U. S. Bureau of Mines. This is a decrease of approximately 2 per cent of the total value of mineral products in 1927 and is caused almost entirely by a decrease in the total value of mineral fuels. Of these, the quantity and value of coal decreased; the quantity of petroleum produced changed little, but the value decreased, and the quantity and value of natural gas and natural gasoline increased as compared with 1927. The total value of metallic products shows an increase, the result of an increase in quantity and unit value of copper and an increase in the quantity of iron produced. Decreases were shown for gold, silver, lead, and zinc. The total value of non-metallic mineral products shows approximately no change.

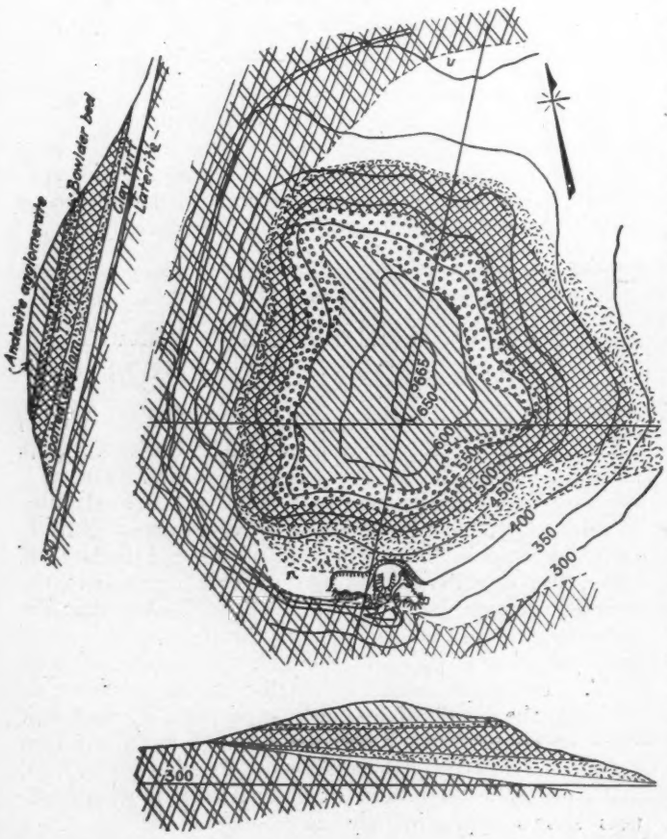
Cutting Clay Production Costs With Systematic Mining Methods

Use of Standard Underground System Increases Recovery at Jones Butte Mine 20 per Cent

By C. N. SCHUETTE,
Mining Engineer, San Francisco

IN 1925, the Jones Butte clay deposit, west of Ione, Amador County, Calif., had been explored to the point where the general dip and strike and the underground limit of the commercial clay had been determined. The deposit had been mined for a number of years. At first open-cut mining was employed, but when the overburden became too great for economic production by this method, underground mining began at the western end. At this date, the geological and structural relations were not at all clear. Tunnels were driven into the deposit from the outcrop in the open cut and the clay was extracted by room-and-pillar mining. No regular system was possible, owing to the changing floor slope and irregularly distributed buttocks of red laterite in the lower part of the clay. Large pillars had to be left to support the back, as the sloughing action of the clay and clay tuff caused apprehension. No timbering was used except at the mouth of the tunnels. Later, when the necessary experience had been gained, the large pillars were robbed and extraction reached about 60 per cent.

Fig. 1—Geological map of Jones Butte



This was the situation in 1925, when it was decided to proceed with mining on a more systematic scale to obtain greater extraction and lower costs. Before detailing the system now in use, which offers both these advantages, a description of the geology of the property and some of the economic features affecting it should be of interest.

The Jones Butte deposit, which lies in the north central part of the Arroyo Seco Rancho, is controlled by the Stockton Fire Brick Company, of San Francisco. It rises about 400 ft. above the surrounding country and is only 1.5 miles from a spur of the Amador branch railroad of the Southern Pacific. The road is a dirt road, built by the company, the grade generally favoring the load.

The U. S. Geological Survey places the hill, shown in Fig. 1, in the Ione formation. Jones Butte is a residual hill in an eroded plain. A hard, flat-lying andesite agglomerate, now about 100 ft. thick, acted as a cap rock to protect the softer underlying beds from erosion. Below the cap rock is a flat-lying bed of loosely cemented boulders which may be about 50 ft. thick, although the lower contact is not very distinct. No unconformity between the cap rock and the boulder bed appears. Apparently unconformably below the boulder bed is a white tuff about 50 ft. thick on the southwest slope and increasing to a thickness of 100 ft. on the northeast slope. Below the tuff is another agglomerate, which varies from a few feet in thickness on the west and north to about 50 ft. on the south and east exposures.

The outcrop has a characteristic brown spotted appearance. The next lower stratum, which appears to be a fairly coarse-grained and somewhat discolored tuff, contains the clay bed. It thins out to a feather edge on the west side of the hill, but increases in thickness toward the east. At the mine it has a thickness of about 25 ft. Below the clay tuff is a red laterite rock, which can be taken as the basal rock formation of the surrounding area.

The clay deposit is a limited portion of the clay tuff formation. Its bottom is sharply defined by the laterite formation and is somewhat irregular, occasional great buttocks of the red rock extending into the clay bed.

Patches and streaks of apparently pure hematite are also found along the bottom. A fairly regular dip to the east characterizes the clay-laterite contact, except at one point, where a sharp fold occurs, as shown in the upper sketch of Fig. 2. The top of the clay is also well defined. The upper one-eighth to one-fifth of the clay bed has a grayish tinge when freshly exposed, in contrast to the pure white of the lower clay. This gray tinged or "unctuous" clay is more plastic, and, when the

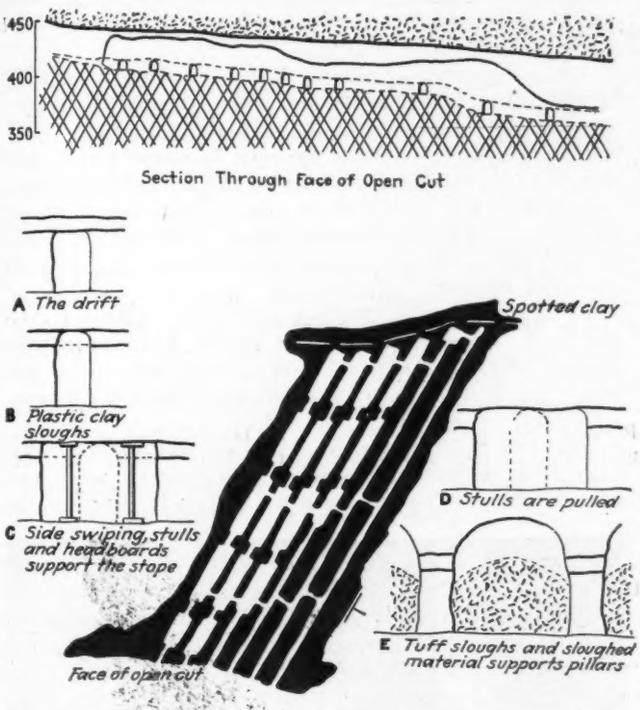


Fig. 2.—Details of mining method, plan and cross-sections

lower white clay has been removed, the gray top layer will slough and leave a clean back against the overlying tuff.

At the outcrop, when stripped of surface detritus, the clay is as clean as that underground. At a distance of some 300 ft. into the hill from the outcrop it is spotted with brown iron oxide. An exploratory drift was carried about 350 ft. northeast into this spotted clay. From the end of the white clay on, the kaolinization of the clay or clay-tuff rock became less as the tunnel proceeded into the hill, and the material more closely resembled the unaltered tuff. The brown spotted clay is not mined. Its appearance marks the underground limit of mining.

The clay bed is between 8 and 10 ft. thick in the western workings, where the deposit was first developed. Below the sharp fold it is thicker. In general, it strikes about N. 30 deg. E. and dips to the southeast about 7 deg., the dip, however, becoming steeper toward the east.

The softening point of the clay is at cone 34+ and a typical analysis indicates: silica, 43.48; alumina, 40.14; ferric oxide, 0.92; lime, 0.30; magnesia, 0.20; alkalies, 0.26; water minus 110 deg. C., 1.10; water plus 110 deg. C., 13.60 per cent.

The clay is an alteration product of the clay tuff and was formed practically in place by the kaolinizing action of meteoric waters and humus acids. Brown iron oxide still found in the inner portions of the clay bed was probably carried into the originally white tuff from the underlying laterite by magmatic waters. In forming the underlying laterite, magmatic waters again were probably instrumental, and deposition of iron in the overlying tuff and agglomerate was probably an accompanying reaction during lateritization of the lower formation.

In comparing the tuff found above the clay bed with the tuff found farther in the hill beyond the limits of the clay, the fact has been noted that the tuff above the clay appears to be much more porous. Again, the unaltered or only partly altered tuff found far in the hill is less dense than the clay. From these facts the conclusion is warranted that the finer and more easily leached portions of the tuff lying above the present clay deposit were carried down and were deposited as an integral part of the clay bed during its formation. After this material had been carried down the original process of alteration to clay was practically complete.

The upper one-eighth to one-fifth of the clay is much more plastic than the lower part. The plasticity of a clay is thought to be due to contained colloidal substances such as humus. Long-continued action of the surface waters carrying colloidal matter after the alteration to clay is thought to be due to contained colloidal substances greater plasticity of the upper part of the clay bed.

Method of Operation

The method of operation now in use is as follows: Very narrow drifts are driven from (at first the main tunnel) the face of the open cut into the clay bed toward the northeast and just sufficiently off the strike of the deposit to give a small grade in favor of the load. The drifts are just wide enough for the mine cars to pass and are not timbered. The back of the drift is kept even with the top of the white clay and is allowed to arch by the sloughing of the plastic top clay. Wide drifts cave when not supported by timbering. The drifts are spaced 20 ft. apart, on centers measured perpendicular to the strike, and are advanced until they strike the brown spotted clay. Connections for ventilation are cut through from one drift to the other as needed.

Hand augers are used for drilling. Large augers, 2½ in. diameter, are best, as larger holes make possible placing all the powder (20 per cent explosive is used) in the bottom of the hole. This is the only effective way of breaking the clay. Four- to six-hole rounds are

Fig. 3—Cross pillars on both sides of the drift. Caved stope in the background.

used, the holes being 4 to 5 ft. deep. Shots "bootleg," leaving holes 6 to 10 in. in diameter. Slick sheets are laid down before blasting, and the clay is shot down on these to aid shoveling.

When a drift has been extended to the underground

Fig. 4—Loading bin at the mine

limit of mining, stoping or "side swiping" is started. Beginning at the face, 5 ft. of clay is shot down on each side of the drift. Shots are placed low in the white clay, and the plastic top clay is allowed to slough or is picked down. This gives a clean back over the full 15-ft. width of the stope, which is then supported by 4x6-in. stulls and head boards. As the room or stope retreats by successive "sideswipes," stulls are pulled and recovered some 20 ft. behind the stope face. The back of the stope is allowed to slough. Sloughing of the unsupported stopes proceeds rapidly until a natural arch has been formed. Fallen material gives a certain measure of support to the wall pillar between the stopes. Should the wall pillar between two stopes show signs of crushing, a small cross pillar is left and the stope is started behind it again. The mining method is illustrated in Figs. 2, 3 and 6.

Method Recovers 80 per Cent, Leaving 20 per Cent for Support

A measurement of the area stoped by the new method indicates an 80 per cent recovery with only 20 per cent left to support the workings, compared with 60 per cent formerly. The method was used in working from west to east until the sharp fold in the clay bed was reached. Here a heavy flow of water, increased thickness of the clay, and the steep inclination militated against any regularity of operation. East of the fold, however, the mining method as outlined is used. The clay bed is thicker at this place, and it has been found better to undercut the clay instead of drilling and blasting it in the stopes, there being less danger, when undercutting is done, of crushing the higher pillars.

Recovery of stulls is an important item in mining cost. Stulls must be pulled before they have taken too much weight. The floor is picked at the foot of the stull, and it is then pulled down by a rope. Stulls farthest from the working face are pulled first, and the stull puller stands in the timbered part of the stull when working. Stull pulling must be accurately timed and is made a part of the regular routine of mining. On one occasion, a twelve-hour delay of the stull-pulling operation from the routine time proved too long. The stulls could not be pulled; they bent badly; and finally the whole back came down at once, crushing the stulls. Continuous and steady operation by the method described in the foregoing gives the best results.

Fig. 5—Loading platform at railroad spur

Where systematic mining is not possible because of irregularities, elevations of the floor—"monkey" drifts—are generally extended in the clay above the floor level, and the clay is brought to the drift in wheelbarrows and dumped into the mine cars. The clay is light, weighing only 100 lb. per cubic foot in place. It is easy to shovel and the wheelbarrow runs are short. The method works so well that a 60 per cent recovery is obtained even in the most irregular ground.

From the mine the clay is trammed to a 50-ton bin on the road. From this bin it is loaded into dump body trucks, which take it to the loading platform on the railway spur, where the truck is dumped directly into gondola cars.

The new mining system is satisfactory, about 1,000 tons being extracted monthly. Preparatory work can be extended without the use of timber by keeping the drifts narrow. Powder consumption is small if large holes are drilled, if the powder is placed in the bottom of the hole, and if the holes are well tamped. In stoping, clean clay is recovered by taking advantage of the sloughing characteristics of the top layer of clay. When undercutting is used, no powder is required for the stoping operation.

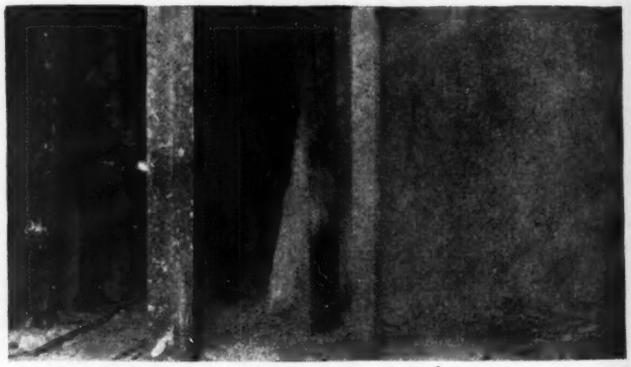


Fig. 6—Stope face at the right and drift at the left

Russia Is Reported to Have Granted Exclusive Radium Development Rights

The exclusive right of development of radioactive raw materials in Russia is reported in the French press to have been granted the rare elements cartel in that country, according to the U. S. Department of Commerce. All right to prepare, sell, or work with such raw materials is said to have been received by the cartel, which is called the Rjedkij Elementy. The cartel will also have the right, by preference, according to the press report, to acquire and exploit all Russian mines of molybdenum, tungsten, bismuth, strontium, lithium, and cobalt.

The Midvale Smelter Stack

Hollow Clay Tile, Filled With Reinforced Concrete, Towering to a Height of 451 Feet

IN the April 21 issue of last year was published an article descriptive of the new smelter stack at Noranda, Quebec, which was therein stated to be the tallest reinforced-concrete chimney on the American continent. As applied to the ordinary plain concrete type of stack this statement was true, but at the Midvale, Utah, smelter of the United States Smelting Refining & Mining Company is a stack of the well-known Wiederholdt type of construction that is 29 ft. higher. The hollow clay tile, filled with reinforced concrete, serve two purposes, acting first as permanent forms for the concrete, and, second, protecting the concrete against the injurious effect of sulphurous gases. The stack, which has been in service now for seven years, has proved quite satisfactory.

THE stack at the Midvale lead smelter, in Utah, is a circular one, built in eighteen sections. Seventeen of these are 25 ft. high, with a top section 26 ft. 4¼ in. high. The wall thickness varies from 33 in. at the base to 8 in. just below the coping at the top. The first section is 33 in. thick; the next two sections are 27 in.; the next section is 17¾ in.; and the next three sections are 12½ in. to a point 190 ft. from the base. The next 90 ft. is 10 in. thick, and the last 156 ft., 8 in. The chimney proper is a circular barrel, the first 125 ft. of which has a batter of 3.058 per cent, the next 295 ft. having a batter of 2.013 per cent, and the top 31 ft. being vertical.

The bottom 125 ft. of the chimney was built of a combination of radial brick and reinforced concrete. An inner and an outer shell, one radial brick thick, was built to act as a form for the concrete which was placed between them. These brick were radial perforated firebrick made in five lengths—in 10⅞, 9, 7⅝, 5¾, and 4⅜ in.—are varied in width from 5¼ to 6½ in., but all were of a standard height of 6 in. These were laid up in a 1:2:6 mortar of fireclay, cement and sand.

The concrete placed between the brick shells was a rather dry 1:3 mix of cement and sand, which was thoroughly tamped into place. It was reinforced by both vertical and horizontal reinforcing bars. The vertical reinforcement consisted of ¾-in. square-ribbed bars spaced approximately at 23-in. centers, which were tied into the vertical reinforcing bars in the foundation as an anchor. The horizontal reinforcement consisted of ½-in. square-ribbed bars, which were placed on the circle of the vertical bars and spaced every two courses of the radial brick, or approximately at 12-in. centers.

This part of the chimney had two flue openings, one on the south and one on the north. The bottom of the opening on the south was level with the top of the foundation and was 12 ft. 2 in. wide and 22 ft. 2 in. high to the spring line of the arch, which had a rise of 2 ft. 0 in. The bottom of the north opening was 55 ft. 1⅜ in. above the top of the foundation. This opening was 15 ft. 2½ in. wide and 22 ft. 2 in. high to the spring of the arch, which had a rise of 2 ft. 6 in.

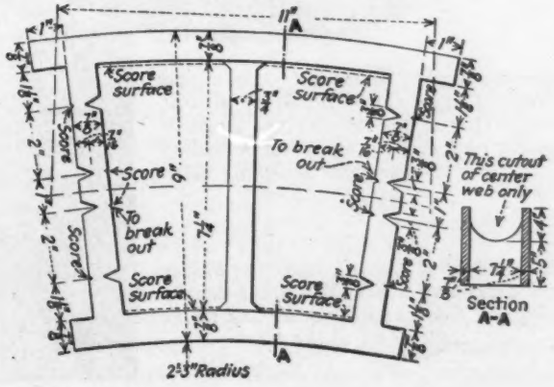
The chimney above the 125-ft. level, except for the top 15 ft. 8¼ in., which corbels out to form a coping, is of the standard Wiederholdt system of construction. This consists in the use of a hard-burned fireclay tile of a shape and design such that it can act as a permanent mold for a concrete body without destroying the continuity of the wall. These tile were made in four lengths—12½, 10, 8 and 6 in.—and with variable widths, but are all of standard height of 9 in. They were bedded in a 1:2:6 mortar of fireclay, cement, and sand. Filling consisted of concrete of a rather dry 1:3 mix of cement and sand, which was tamped into place and also formed the vertical joints between the tile. The tile were formed so that vertical and horizontal reinforcing bars could be introduced.

Up to a height of 225 ft. above the top of the foundation the chimney was vertically reinforced with ¾-in. square-ribbed bars spaced at about 23-in. centers. The horizontal reinforcement consisted of ½-in. square-ribbed bars laid on the circle of the vertical bars and spaced every course of tile. Above 225 ft. the vertical bars were reduced to ½-in. square-ribbed bars and the horizontal bars were, at this point, spaced every two courses of tile.

The top 15 ft. 8¼ in. of the chimney was built of a

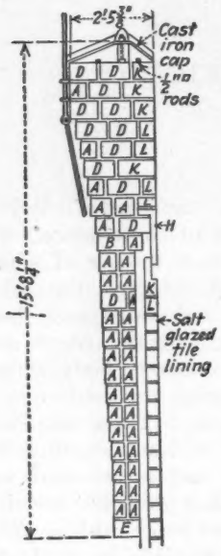
Fig. 1—Detail of Wiederholdt hollow tile

Several sizes of these tile were used, but the general design was the same. Three straight radial sections or walls will be noted. As soon as each tile was placed, the two end walls were broken out, leaving only the center wall or web, the two outside walls being merely for convenience in molding and handling.



combination of Wiederholdt tile and radial brick, and corbeled out so that the wall on which the cast-iron cap rests is 2 ft. 5⅜ in. wide.

To withstand the acid action of the gases the lining was built of acid-proof brick formed in 4⅜-in. perforated radial blocks. These were installed in the usual sectional



Fi. 2—Detail of the top of the chimney

The letters "A," "D," and "E" designate perforated radial brick of different sizes; "L," the brick used for lining; and "H" and "K" were L-shaped tile used at the junctions of sections of lining, laid to permit vertical expansion of the respective sections at the top of the stack

method, the 25 ft. sections being supported on corbels built out from the inner surface of the main chimney. These lining blocks were laid in an acid-proof mortar composed of cement, fireclay, and Utah Copper tailing of the proportions of 1 : 2 : 3½. The lining was laid throughout with a 3-in. air space.

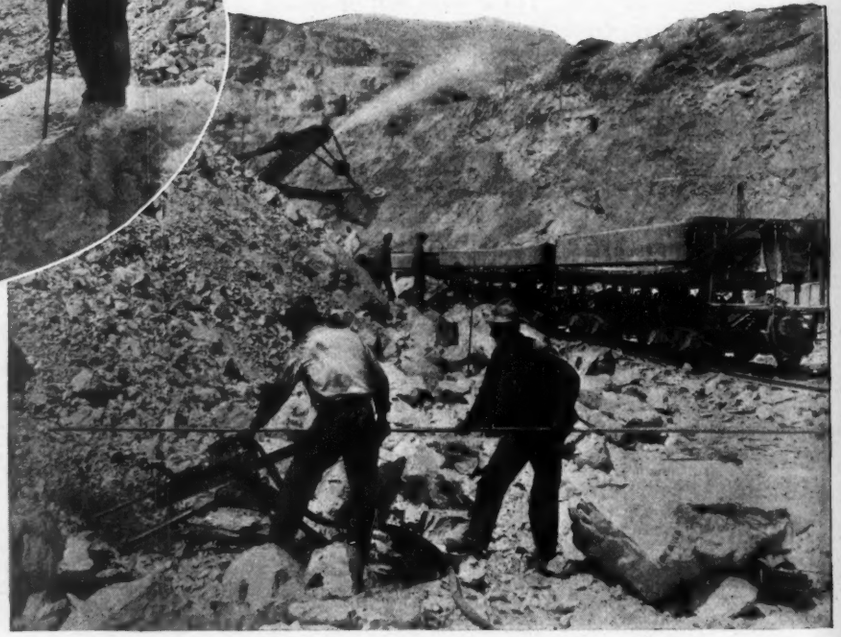
The cap for protection of the top of the chimney walls from the weather and gases was made of cast iron in sections with overlapping joints. Sections of the cap were laid in the acid-proof mortar already mentioned and bolted to the chimney by ¾-in. anchor bolts. These bolts had cast-iron nut guards screwed on their top ends to protect them from the acid of the gases.

The outside safety ladder was made of ⅜x2½-in. iron with ¾-in. round treads. This ladder was made in sections 15 ft. long and had guards every 3 ft. made of ⅜x2-in. bar iron. The ladder had three steel resting platforms made of angle iron located 150 ft., 300 ft., and 435 ft. respectively above the top of the foundation. The platform at the 300-ft. level was made 5 ft. wide and 10 ft. long, the other two platforms being approximately 2 ft. 3 in. wide and 8 ft. 5 in. long. About 3 ft. 9 in. above the large platform a 2½-in. lead-covered and lead-lined pipe was passed through the chimney to be used for taking samples of the gases. The pipe is perforated on the under side with ⅜-in. holes. One foot above the pipe, openings were left in the walls of the chimney for the installation of a pyrometer.

Protection to the chimney from lightning is provided for by an eight-pointed arrester at the cap with two ⅝-in. copper cable connections to the ground. One of these cables was located on the southwest side of the chimney and the other on the northeast side. The eight points around the cap are formed of ¾-in. copper rod, 4 ft. long, terminating in platinum tips and extending about 3 ft. above the top of the chimney. These rods are connected at their lower ends to a ring of ⅝-in. copper cable that encircles the coping. All the lightning-rod work is protected with a coating of sheet lead 1/16-in. thick throughout the upper 35 ft. of the chimney.

Some of the machines that changed a hill into a pit

Above, in the Sacramento pit of the Phelps Dodge Corporation, at Bisbee, Ariz. One of the seventy-five Sullivan rotator rock drills in use for blockholing and similar light drilling.



At the right, a Sullivan water-jet drifter rock drill, with which 26-ft. toe holes are being put in around the walls and in the center part of the pit

Loss Calculations in Dissolving, Leaching and Extraction

By C. V. IREDELL
Westinghouse Lamp Company
Bloomfield, N. J.

LOSSES which occur in dissolving, leaching, or extraction comprise principally that portion of the desired constituent which is discarded with the insoluble residue. Generally such processes are chemically controlled, and analysis shows the amount of the desired constituent in the waste material. If the waste material is weighed or otherwise measured, calculation of the losses is, of course, a simple matter, and needs no further discussion. However, there are many cases where it is neither economical nor convenient to weigh the residue as it goes to waste. This is particularly applicable to the residues from counter-current or continuous leaching and extraction operations, as well as to those from many intermittent operations. In such cases the result of a chemical analysis only on the residue merely serves to indicate whether or not a certain relative standard of extraction efficiency is being maintained. Though this is sometimes sufficient, it is usually more desirable to know exactly what weight, or what fraction of the total desired constituent originally present in the starting material, is being lost. There is a need, therefore, for some relatively easy method of computing such losses, without actually weighing the residue. Such a method of computation is available when certain conditions exist in the extraction or leaching process. These conditions are as follows:

1. The starting material must contain no substance other than the desired constituent which is soluble in the reagent used for extraction.

2. The insoluble residue must either remain unchanged in composition during the operation, or if changed the change must be of such a type that the residue reverts to its original composition on heating.

3. If the desired constituent is extracted as a different compound than that in which it existed in the starting material, the chemical analysis must show in what form the desired constituent remains with the residue.

The last two conditions pertain to operations where the extraction is made with acids, bases or salt solutions. Condition (3) is necessary for extractions of this type when the desired constituent has not been entirely converted to the soluble compound. The chemical analysis, of course, is expected to determine the amount of this insoluble form and the amount, if any, of the soluble compound, which remains with the residue.

When the above conditions are adhered to the loss of desired constituent discarded with the residue may be calculated from one of the following equations. In these equations:

A = Weight of the desired constituent in the starting material per unit weight of starting material. (Dry basis.)

B = Weight of the unchanged desired constituent in the residue per unit weight of residue. (Dry basis.)

B_1 = Weight of the desired constituent in the residue which has been converted to a different compound, per unit weight of residue. (Dry basis.)

(A, B and B_1 are provided by chemical analysis. In sampling the residue it is essential that a true sample of the discarded materials be taken. For example, if the residue passes to waste as a wet slurry after the last leaching, the dried sample of the residue must include all materials in solution as well as the insoluble portion.)

f = Conversion factor of the desired constituent from its original form in the starting material to the soluble compound existing in the residue.

X = Weight of *total* residue per unit weight of starting material.

L = Loss in per cent of the total desired constituent.

Case I—When the desired constituent remains in the residue in the same form in which it existed in the starting material:

$$L = \frac{100\,B\,(1-A)}{A(1-B)} \qquad (1)$$

The above equation is applicable to ordinary leaching or dissolving operations, such as the leaching of weathered or roasted ores, or to extractions with organic solvents.

Case II—When the desired constituent remains with the residue entirely as a different compound than that in which it existed in the starting material:

$$L_1 = \frac{100\,B_1\,(1-A)}{A\,(1-B_1 f)} \qquad (2)$$

Case III—When the desired constituent remaining in the residue is partly as the unchanged original form and partly as the converted compound:

$$L_2 = \frac{100\,(B+B_1)\,(1-A)}{A\,(1-B-B_1 f)} \qquad (3)$$

Equations (2) and (3) can be used when the extraction is made by means of acids, bases or salt solutions. An example of such an operation is in the extraction of tungstic oxide, WO_3, from wolframite ore by means of caustic soda solution. This results in the formation of soluble sodium tungstate, Na_2WO_4. The insoluble residue is leached further with water, but a small amount of

Abstract of a paper by C. V. Iredell in *Chem. & Met.*, November, 1928.

sodium tungstate generally remains and passes with the slurry to a sump. On the dried and ignited sample:

$$f = \frac{Na_2WO_4}{WO_3}$$

If the tungstic oxide has been entirely converted to sodium tungstate, equation (2) is applicable. If the tungstic oxide exists in the residue partly as undecomposed wolframite and partly as sodium tungstate, equation (3) should be used. However, if the analysis shows that the tungstic oxide is present only as unconverted wolframite, equation (1) should be applied. It is evident that each of these three equations is independent not only of the weight of residue, but also of the weight of starting material, and is, therefore, available for control on continuous processes.

The derivation of these equations is as follows:

For case I, insoluble residue = extraneous matter + B. True extraneous matter per unit weight of starting material = $1 - A$; also, true extraneous matter per unit weight of starting material = $X - BX$.

$$X - BX = 1 - A$$

$$X = \frac{1-A}{1-B}$$

Obviously the loss in per cent of the total desired constituent is:

$$L = \frac{100\,BX}{A}$$

Substituting for X,

$$L = \frac{100\,B\,(1-A)}{A\,(1-B)} \qquad (1)$$

Similarly, for case II, insoluble residue = extraneous matter + B_1f. True extraneous matter per unit weight of starting material = $1 - A$; also, true extraneous matter per unit weight of starting material = $X - B_1fX$.

$$X - B_1fX = 1 - A$$

$$X = \frac{1-A}{1-B_1f}$$

and since

$$L_1 = \frac{100\,B_1X}{A}$$

$$L_1 = \frac{100\,B_1\,(1-A)}{A\,(1-B_1f)} \qquad (2)$$

For case III, insoluble residue = extraneous matter + B + B_1f. True extraneous matter per unit weight of starting material = $1 - A$; also, true extraneous matter per unit weight of starting material = $X - (B + B_1f)\,X$.

$$X - (B + B_1f)\,X = 1 - A$$

$$X = \frac{1-A}{1-(B+B_1f)}$$

Since

$$L_2 = \frac{100\,(B+B_1)\,X}{A}$$

$$L_2 = \frac{100\,(B+B_1)\,(1-A)}{A\,(1-B-B_1f)} \qquad (3)$$

These equations may also be derived from a somewhat different basis in the following manner:

Let W = Weight of the starting material.
s = Weight of the desired constituent extracted
y = Weight of the desired constituent in the residue.
z = Weight of the other material in the residue.

Then

$$s + y + z = W \qquad (a)$$

$$\frac{s+y}{W} = A \qquad (b)$$

$$\frac{y}{y+z} = B \qquad (c)$$

$$\frac{100\,y}{s+y} = L \qquad (d)$$

From (b),

$$W = \frac{s+y}{A}$$

Substituting in (a),

$$s + y + z = \frac{s+y}{A} \qquad (e)$$

From (c),

$$z = \frac{(1-B)y}{B}$$

Substituting in (e),

$$s + y + \frac{(1-B)y}{B} = \frac{s+y}{A}$$

$$1 + \frac{(1-B)y}{B\,(s+y)} = \frac{1}{A}$$

$$\frac{y}{s+y} = \frac{B\,(1-A)}{A\,(1-B)}$$

Substituting in (d),

$$L = \frac{100\,B\,(1-A)}{A\,(1-B)} = \text{Equation (1)}$$

Equations (2) and (3) may be similarly derived.

Flotation of Sulphides of Copper and Oxidized Minerals

EXPERIMENTAL work on the floatability of the sulphides of copper and oxidized minerals is being conducted at the Intermountain Experiment Station of the U. S. Bureau of Mines, Salt Lake City, Utah, in co-operation with the department of mining and metallurgical research of the University of Utah. A brief résumé of the more recent results obtained follows:

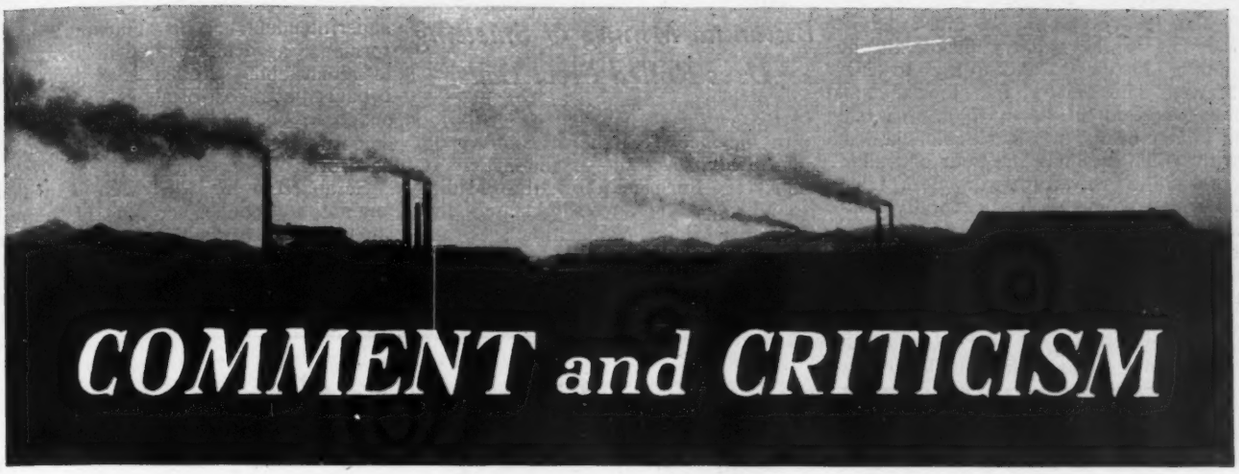
Xanthates, mercaptans, and thio-phenols, particularly those containing large hydrocarbon portions, such as amyl compounds, are good reagents for collecting malachite and azurite in the presence of any kind of gangue. The larger the hydrocarbon part of the molecule of these reagents, the less reagent is needed. The amount of reagent needed is largely dependent upon the quanity of malachite or azurite and the surface developed on these minerals.

A few active depressing agents for chalcocite have been found. Among these are inorganic sulphides, thiosulphates, ferri-cyanides, ferro-cyanides, and sulphites.

The action of copper salts on sphalerite is a double decomposition, resulting in the formation of a surface coating of covellite. Lead, mercury, and silver salts all coat sphalerite in a similar way. The galena coating obtained by means of lead salts is readily formed even at temperatures below the boiling point of water.

Sphalerite that has a sure ZnS surface is practically non-floatable. It is the presence of contaminated areas on its surface yielding CuS or PbS surfaces that results in sphalerite being oftentimes rather readily floatable.

Mixtures of sphalerite, pyrite, and calcite can be so treated as to float either the sphalerite or the pyrite with the same collecting agent. The combination of lime and copper sulphate results in flotation of the sphalerite. Addition of no modifying or depressing agents results in flotation of the pyrite. White mica can be floated from brown mica and feldspar (on an ore) through the use of soap in the proper quantity.



COMMENT and CRITICISM

Seeing Brazil with a Mining Engineer a Hundred Years Ago

To the Editor of "E. & M. J.":

The visit of Mr. Herbert Hoover, President-elect, to the great republic of Brazil, although chiefly of political significance, will also be an indirect stimulus to the varied and vast mining industry of this southern republic, now in an interesting stage of revival.

Brazil has had a long history in mining. The gold placers of the state of Minas Geraes (general mines) were flourishing as early as the seventeenth century, long before the gold of California was discovered, and, according to historical records, were quite as rich in gold. In an ancient report written by a man who was also a mining engineer, or "mineralogist," as was the designation of the time, is a record of the mining activities in Brazil more than a century ago. This publication bears the comprehensive title, "Travels in the Interior of Brazil, particularly in the Gold and Diamond Districts of that Country, by authority of the Prince Regent of Portugal, including a voyage to the Rio de la Plata, and an historical sketch of the revolution of Buenos Aires, illustrated with five engravings." The author is John Mawe, an Englishman, described as the author of a treatise on the "Mineralogy of Derbyshire," and highly spoken of as to his scientific attainments in a review in the *British Critic*, 1813. The book was published in Philadelphia by M. Carey, and in Boston by Wells & Lilly, in 1816. Presumably English editions had preceded the American publications. It is characteristically dedicated to "His Royal Highness, the Prince Regent of Portugal, Prince of Brazil, etc," under whose sanction the travels were "performed."

The first chapters of the book are devoted to the voyage from Cadiz to the Rio de la Plata, made in 1804, and discuss some forgotten phases of the "world war" of that day, involving a frustrated British naval expedition against Buenos Aires. The author succeeded, however, in undertaking some limited travel in the Argentine and in Uruguay, and he describes the physical and commercial conditions of that time in an interesting manner and makes some pertinent political observations. Later he traveled by boat and overland to Brazil and arrived at Rio de Janiero in the spring of 1809, where he was received by the Prince Regent, apparently with much ceremony, and was commissioned to make a trip into the interior of Brazil to the famous gold and diamond regions of Minas Geraes, an opportunity not apparently made available before for foreign travelers.

The details of the laborious and difficult trip on muleback from the, even then, important political and commercial center on the wonderful harbor of Rio de Janeiro is interesting reading to one who now can make the trip on a modern railroad in a short day with an equipment of sleepers and dining cars. The incidents and observations, however, principally consisting of a catalog of discomforts, inconveniences, and sometimes dangers, are strangely familiar to the present-day traveler whose wanderlust has led him away from the railroads, main highways, and the scattered and confined centers of civilization in Brazil, or in fact in any other Latin American country.

The first stage of the journey ended at Villa Rica, then an important center of mining operations and the capital of Minas Geraes. The writer observed that the place had for many years been "reputed the richest in Brazil, as to it was brought all the gold found in the vast district." His description of the official and private buildings and the general state of business and society in this historic place is an interesting record, for Villa Rica (rich town) is no more. A gashed and torn hillside, a few scattered stones, fragments of walls, and a half dozen miserable native huts are all that now are to be observed at this place. The designation is still applied to the locality which lies on the outskirts of Ouro Preto, an important city, for many years the capital of the state and now the seat of the celebrated school of mines. All of the mining operations were confined to surface and placer work at that time, and the record of the enormous richness of the region in gold, the production of which had at this early time materially declined, recalls the stories of "the days of old and the days of gold" of California.

After further travels in the gold region, our writer passed northward to the diamond fields, in which the most important mining operations in the country were then under way, conducted by the government with slave labor. The descriptions of the mining methods and of the elaborate arrangements to control and direct the waters of the rivers to make the *cascalho*, or diamond gravel, accessible, are evidence of the effectiveness of the early-day mining operations. The writer describes the discovery of a very large diamond, nearly an ounce in weight, by three outlaws, who, by their delivery of their find to the authorities, secured social restoration. Another instance is told of a negro, living 900 miles in the interior, who sent word to the Prince Regent that he had discovered a diamond weighing nearly a pound, which he wished to present to his Majesty. It it not necessary to record that the offer was accepted. The fortunate finder was brought to Rio de Janeiro, under escort, and was treated with great consideration on his journey with the precious find to the capital. The stone was personally accepted by the Prince Regent and safely ensconced in the treasure chest, locked with three locks, the keys of which were held by three separate functionaries. The diamond was received at the time of Mr. Mawe's arrival in Rio de Janeiro, and because of his reputation as a mineralogist, he was consulted by the Prince Regent, who, it seems, had some doubt as to the genuineness of the find. Mr. Mawe readily ascertained that the alleged diamond was only a rounded crystal of quartz, and the negro returned home without escort.

Mr. Hoover would be interested in the diet of the country people in the mining districts. According to Mr. Mawe, "The Master, his steward, and the overseers sit down to a breakfast of kidney beans, of a black color, boiled, with which they mix the flour of Indian corn and eat with a little dry pork, fried or boiled. The dinner generally consists also of a bit of pork or bacon, boiled, the water of which is poured upon a dish of the flour above mentioned, thus forming a stiff pudding. A large quantity (about half a peck) of this food is poured in a heap on the table, and a great dish of boiled beans is set upon it; each person helps himself in the readiest way, there being only one knife, which is very often dispensed with. A plate or two of colewort or cabbage leaves complete the repast. The food is commonly served up in the earthen vessels used for cooking it; sometimes on pewter dishes. The general beverage is water. At supper nothing is seen but large quantities of boiled greens, with a little bit of poor bacon to flavor them. On any festive occasion, or when strangers appear, the dinner or supper is improved by the addition or stewed fowl. The food prepared for the negroes is Indian corn flour mixed with hot water, in which a bit of pork has been boiled. This dish serves for both breakfast and supper. Their dinner consists of beans boiled in the same way."

Mr. Mawe's book is a very interesting account of the social, political, and industrial conditions of the Brazil of a century ago. It is worthy of being republished and made available to all interested in Latin America.

New York City. KIRBY THOMAS.

The Engineer-Metallurgist

Apropos of the editorial on "Construction Supervision Should Not Be Divorced From Design," in the issue of Jan. 26, a well-known metallurgical engineer writes as follows:

"I find myself very heartily in accord with the point of view which you present, and I could cite many instances in support of your contention. There is one practical difficulty as things now stand, and that is the extreme scarcity of men who have a knowledge of the fundamentals of both chemistry and engineering. To reach a proper standard in these two respects it is almost impossible to avoid having to take two separate degrees at a university, and this represents an expenditure of time and money that the ordinary student is quite unable to undertake. There is accordingly a widespread belief on the part of the executive that for a problem involving both metallurgy and engineering it is essential to employ two different individuals. I find myself constantly under the disability of being supposed to know nothing about the permissible loading of a steel channel because I am known to be able to write down the general chemical equations covering the solution of a roasted concentrate in an acid."

Britannia Mining & Smelting Uses Rolled Steel Balls

To the Editor of "E. & M. J.":

In the Dec. 15 issue of *Engineering and Mining Journal* in the article on "Electric Furnaces for the Mining Foundry," I erroneously stated that Britannia Mining & Smelting uses cast-iron balls. Steel balls are used, rolled from heavy rail scrap in a steel-ball machine developed by A. C. Munro, mill superintendent. This machine's performance as demonstrated at Britannia is remarkable. Rolled steel balls are produced at a cost of about $25 per ton, or about 3c. per ton of ore ground. The material treated is an extremely hard ore.

Scrap from the ball machine, which amounts to about 4 per cent. of the rail stock, is melted in an electric furnace for making roll shells.

ALBERT E. GREENE.

Seattle, Wash.

Consultation

Requirements for Listing on New York Curb Exchange

"Will you advise me as to the requirements for listing a mining company stock on the New York Curb?"

The secretary's office of the New York Curb Market is authority for the following in connection with the listing of mining company stocks:

This exchange will only accept applications for regular listing of stock actually issued and outstanding, instead of the amount authorized.

The fees covering such applications will be charged on the following basis: When the company first makes application to list its outstanding stock, the application fee shall be $1,000. Any increase thereafter, there shall be a charge at the rate of one cent (1c.) a share, not to exceed $1,000. For instance, if the company issues 100,000 shares of additional stock, the fee would be $1,000; if the increase be 50,000, then the fee would be $500.

Application to the New York Curb Market to list securities must be accompanied by the following requirements:

1. Statements of assets and liabilities, earnings and expenses, signed by a public accountant or certified public accountant.

2. Engineer's report as at a recent date or a certified copy thereof.

3. Certified copies of the certificate of incorporation and all amendments made by an officer of the company or by its attorney. Also certified copy of certificate of Secretary of State covering date of filing of articles of incorporation and each amendment.

4. Certified copy of the bylaws with all amendments.

5. Claim map covering all of the company's properties.

6. A certified copy of last annual report, if any was published.

7. A certified copy of prospectus, if any has been prepared.

8. A history of the company written and certified by an officer. (Include a detailed description of properties, and also a detailed description and history of all corporate and capitalization changes.)

9. If a holding company or a consolidation, furnish a complete certified list containing the names and addresses of all subsidiary companies, description and location of properties, capitalization of each, and manner in which control is vested in the applying company.

10. A complete list of claims, with acreage and location of each, certified.

11. A list of the officers and directors, with their addresses, and an individual banking reference for each.

12. Transfer office and registrar (a corporation) at New York.

13. A complete certified list of all leases with exact locations of each and also certified copies of all leases.

14. Attorney's confirmation of the titles to all of the company's properties, certified.

15. Specimen copies New York stock certificates covering all denominations of each class of stock. If transfer office and registrar are maintained both in New York and other cities, furnish specimens of certificates used outside New York City.

16. Application fee $1,000 payable in New York funds.

The exchange will publish, for the information of its members, bulletins containing general information compiled from the data submitted by the company in its application for listing, and each company will be required to pay the cost of printing and mailing of such bulletins. A charge of $100 will therefore be made to cover this expense in addition to the application fee.

17. Statement giving amount of outstanding shares distributed and in the hands of the public, which must be at least 15 per cent, exclusive of officers, directors, syndicate managers, or agents.

18. Record of dividends on all classes of stock from initial payment to date, including record and payable date, rate and amount of each.

19. Funded indebtedness. Furnish a complete certified list of all bonds or notes authorized, stating amounts authorized, class of mortgage, when dated, when due, interest rate, interest dates, and where principal and interest are payable.

20. Furnish a certified statement of recent and present developments or operations at the company's properties.

21. All papers submitted in accordance with the requirements enumerated above must be certified as true and correct by an officer of the company and must bear the company's official seal.

Personal Notes

Bela Low, mining engineer, has gone to Porto Rico, where he will remain about a month on professional business.

John S. Crawhall, of the Dravo Contracting Company, Pittsburgh, Pa., was recently in San Francisco after visiting Arizona.

Douglas Mutch, mining engineer, has completed an examination of the Buckingham property in the West Shining-tree district, Ontario.

P. R. Bradley, consulting engineer for Treadwell Yukon, has returned to San Francisco from the Errington mines of the company in the Sudbury district, Ontario.

Kenneth Johnston has been appointed mining engineer of the Lafayette Fluor Spar Company, at Mexico, Ky. He was formerly with Oliver Iron Mining at Virginia, Minn.

Douglas S. Baird, geologist, is in charge of operations at the Michipicoten property of Mammoth Mines, Ltd. He was formerly with Dome Mines, in the Porcupine district, Ontario.

W. H. Oldham has been appointed vice-president in charge of operations at the properties of the Republic Iron & Steel Company in the Birmingham district. He succeeds Charles T. Fairbairn.

J. P. B. Webster, secretary of Russo-Asiatic Consolidated, is now in Russia conducting negotiations which it is hoped will result in the return of some of the company's concessions by the Soviet.

C. F. Adami, general manager of the St. Joseph Lead Company, at Bonne Terre, Mo., returned to Missouri this week after spending two or three weeks on a business trip to the headquarters of the company in New York.

R. S. Botsford is making examinations for Fraser, Brace, Ltd., of Montreal in the neighborhood of Medellin, Republic of Colombia. Mr. Botsford was formerly director at the Zancudo mine, in the Titiribi district of Colombia.

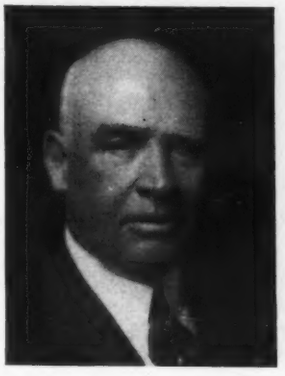
M. W. Summerhayes, consulting engineer, who recently completed a report on the Wright-Hargreaves mine, in the Kirkland Lake district, Ontario, has been engaged to make an examination of Abana Mines, in the Rouyn district, Quebec.

Amor F. Keene, consulting engineer, of New York, has been appointed consulting engineer of the Whitworth Finance & Mining Corporation, Ltd., which was recently organized in London to acquire properties in Queensland, southwest Africa, and Alaska.

John G. Barry, geologist for the Howe Sound exploration department, with headquarters at El Paso, is convalescing at the Johns Hopkins hospital in Baltimore from a successful operation involving the removal of a bullet from his thigh, an injury suffered during the World War.

E. W. Widdowson, president of the Chamber of Mines of Eastern British Columbia for the last two years, was unanimously re-elected at the annual meeting of the organization held in Nelson, B. C., on Jan. 15. Other officers elected were, **Dr. W. O. Rose,** first vice-president; **W. R. Hunter,** second vice-president; and **Dr. H. B. Morrison,** treasurer.

Cornelius F. Kelley, president of Anaconda Copper Mining, was named a knight of the Order of Malta on Jan. 23, together with several other prominent Americans. The organization called the Knights of Malta is really the ancient organization known as the Hospitallers of St. John of Jerusalem.



CORNELIUS F. KELLEY

R. S. Dean, head of the research department of Western Electric, spoke on "Recent Advances in the Art and Science of Fabricating Metals," before a meeting of the Missouri Mining and Metallurgical Association, on Jan. 24. He declared that non-ferrous alloys have been placed in the same class as steel by recent metallurgical research on the possibilities of hardening.

J. C. Kinnear, general manager of Nevada Consolidated, operating in the Ely district, was recently re-elected president of the Nevada Mine Operators' Association. Other officers elected were **A. W. Lawry,** superintendent of Goldfield Consolidated, first vice-president; **H. A. Johnson,** superintendent of Tonopah Mining, second vice-president; and **Henry M. Rives,** secretary-treasurer.

James H. Rough, assistant superintendent of Cleveland-Cliffs Iron, recently retired after 51 years in iron mining. He was born in the Lake Superior iron ore district and started to work at the Jackson mine, near Ishpeming, Mich., as a miner in 1878. In 1903 he was appointed assistant superintendent of all the Cleveland-Cliffs properties in Michigan and occupied that position until his retirement.

Sir Cecil L. Budd has resigned as managing director of British Metal Corporation, although he will remain on the board of directors and also continue chairman of the company's management committee. Sir Cecil is also chairman of the Metal Market & Exchange Company, Ltd., British (non-ferrous) Mining Corporation, and Cornish Tin Smelting. He is also interested in National Smelting, Eastern Smelting, and Tanganyika Concessions.

Clarence C. Spohn, superintendent of the zinc leaching plant of Anaconda Copper at Great Falls, Mont., has resigned to accept a position at the new electrolytic zinc plant of the Norske Zinkkompani, at Odda, Hardanger, Norway. **George F. Setzer,** formerly superintendent of the zinc plant electrolyzing department at Great Falls, has been appointed to succeed Mr. Spohn. He will be succeeded, in turn, by **H. D. Houghton** as superintendent of the electrolyzing department.

Dr. Edward Dean Adams, engineer and financier, of New York, and Colonel **Arthur S. Dwight,** former trustee of Columbia University, have been elected to honorary membership in the Association of Engineers of Louvain, the Engineering Foundation announces. This is the third Belgian honor to be received by Dr. Adams within a few months. Recently he was decorated by King Albert as Commander of the Order of the Crown of Belgium in appreciation of his work as chairman of the committee on a war memorial to American engineers who took part in the World War. Colonel Dwight, formerly president of the A.I.M.E., was also a member of the committee on the war memorial.

OBITUARY

Dr. Leonard Waldo, consulting metallurgical engineer, died at Plainfield, N. J., on Jan. 25. He was born in Cincinnati 75 years ago and studied at Marietta College, the Columbia School of Mines, and Harvard University. He was for a time consulting engineer for the U. S. Steel Corporation, and was also a member of the A.I.M.E.

Charles E. Mills, mining engineer, and president of the Valley Bank and Apache Powder companies, died in Phoenix, Ariz., on Jan. 17. Mr. Mills, who was a native of Iowa, was 62 years old. He graduated from Harvard University with a degree in mining engineering and came to Arizona in 1888. At different times he was connected with the Copper Queen, Inspiration, Detroit, Senator, Big Bug, and Commercial mines.

Henry Rensselaer Batcheller, mining engineer, of the class of 1894 at the Massachusetts Institute of Technology, died in Boston, Mass., on Jan. 16, 1929, very suddenly from coronary occlusion and aortitis. He was born in Annapolis, Md., on Feb. 8, 1873. His early mining work was in Montana, Colorado, Mexico and Nevada. Later, before the war, he was engaged in mining and mineral industry work in the east. He was appointed, by President Wilson, a member of the War Industries Board of New Hampshire. After the war he served as one of the agents of the staff of the employers' division for the War Labor Arbitration Board, presided over by Justice W. H. Taft. Recently he had retired from active work. He is survived by a brother, James Hervey Batcheller, professor of mining engineering at the School of Mines, Oregon State College at Corvallis.

Recent Technical Publications

Natural Behavior of Magmas

THE EVOLUTION OF THE IGNEOUS ROCKS *By N. L. Bowen. Pp. 334. Princeton University Press, Princeton, N. J. Price $5.*

THIS book results from many years of experimental research in the laboratory on silicate melts—research conducted in an effort to explain the natural behavior of magmas. The work was chiefly of a physical-chemical nature and involved investigation of binary and ternary systems such as anorthite-diopside, forsterite-silica, and diopside-forsterite-silica. The author has given the results of recent work done by himself and his collaborators, has included the text of many of his earlier papers, and has presented an interesting, penetrating discussion of the origin of various igneous rock types. The field has been in part his laboratory, for certain areas there have been chosen and the igneous rock diversity has been explained on the basis of fractional crystallization.

That the book is technical and of interest chiefly to the petrologist is explained by the author in his preface: "A knowledge of the accumulated facts of petrology, such as would be obtained in a general course, is assumed. . . . It is an attempt to interpret the outstanding facts of igneous-rock series as the result of fractional crystallization."

In Part I the author points out that liquid immiscibility and fractional crystallization have been suggested as methods of effecting magmatic differentiation. He discusses the results of laboratory experiments on the immiscibility of the important rock-forming oxides with silica, and concludes the chapter with this statement: "On the basis of immiscibility of any kind, it is impossible to build up an adequate explanation of the associated members of rock series, which is the fundamental problem of petrology." Thus he concludes that fractional crystallization is the chief method of obtaining igneous-rock series.

The idea is prominent that the partly crystallized magma is acted upon by deformative agencies, resulting in the expulsion of the liquid part. The author shows how this procedure, as applied to parental basaltic magmas, may give rise to igneous-rock series.

In chapters 9 and 10 Dr. Bowen explains how crystal sorting and assimilation may determine the final composition of igneous rocks.

In Part II he takes up in detail the formation of special magma types such as the lamprophyres and those very rich in potash feldspar, and devotes a chapter each to "Importance of Volatile Constituents" and "Petrogenesis and Physics of the Earth."

Throughout, the text is rich in tables and physical-chemical diagrams, those of Chapter IV (Crystallization in Silicate Melts) and Chapter VII (The Liquid Lines of Descent and Variation Diagrams) being of special value in following the discussion.

The author has gathered a great amount of information relative to silicate melts—their behavior and their deduced behavior, and with suitable diagrams has placed this before us in its logical sequence. Those interested in igneous rocks and their genesis will find in this book a straightforward and scientific discussion of the origin of various rock types—which Dr. Bowen and only a few others have to offer.

DONALD M. FRASER.

Research and Dividends

THE HANDWRITING ON THE WALL. *By Arthur D. Little. Atlantic Monthly Publications. Little, Brown & Company, Boston. Pp. 287. Price $2.50.*

"THE price of progress is research, which alone assures the security of dividends." This, the handwriting on the wall, forms the subject of the book under review, the author of which is one of the best-known industrial chemists of today. He has been associated with the development of many of the newer industrial processes, and his work, especially in connection with the sulphite treatment of wood pulp and the manufacture of artificial silk, has been noteworthy. His long acquaintance with chemical research makes him exceptionally well fitted to discuss the future of industry from the chemist's point of view. He deplores the fact that the executives of so many of the great industrial companies do not—and that some will not—realize the necessity for research, and gives many instances where the success or failure of an organization was due to work done in its laboratory. It is vital to the welfare of almost every company that it be provided with a well-equipped laboratory, and that it employ a staff of efficient, well-trained chemists, capable of creative thinking. The day when a company has no need of research is over, and the life of the organization that employs, tucked away in some hole in the wall, a so-called chemist, usually of the type who requisitioned "methyl orange juice and a brunette with meniscus," of which there are many today, will be short in the competitive world of the future.

The reader is taken from the chapter on the significance of chemistry as a investment to one containing a discussion of fuels. Coal, the fuel of today, will eventually be supplanted by gas, asserts the author, who presents many interesting facts to support his statement, some of which are startling. A description of the part played by the chemists in the late war, and the importance his work will assume in future struggles, is well told. The work of the chemical department of the Army is evidently as important as that of the soldiers.

The last two chapters deal with natural resources and how they may be developed to best advantage, and a tribute is paid to those whom Dr. Little calls the Fifth Estate—men engaged in the work of serving humanity by their work in the advancement of science.

The subject is presented in a comprehensive and interesting form, and provides excellent educational reading for the layman as well as the technical man. Even the well-trained scientist could learn much from a perusal of this volume.

C. H. ALLEN.

UNDERGROUND PRACTICE IN MINING. *By Bernard Beringer. Pp. 255. Mining Publications, Ltd., London. Price 20s.*

IN the preface to this book, the author, the son of the well-known and late lamented J. J. Beringer, states that the subject is treated from the point of view of underground efficiency. The work is based upon personal notes taken in the field during about twelve years of underground experience on the Rand and the Indian gold mines and in Cornwall, as well as from a study of various published material.

Probably one of the first things to be noted is the omission of the subject of underground transportation. No reference appears to the use of the scraper underground. Support of workings, shafts, development, and stoping are considered, as well as application of explosives, compressed-air practice, mine ventilation, mine sampling, and mine organization. Necessarily, a good deal of the material has been discussed before in one form or other. Under the subject of axioms for mining engineers are some naïve observations of interest which give a personal flavor to a more or less dry subject. On the whole, the book is principally valuable in comparative studies of mining practice.

RHODESIAN MANUAL ON AGRICULTURE, INDUSTRY AND MINING. *Edited by C. Carlyle-Gall. Mining & Industrial Publications of Africa, Ltd., Johannesburg, South Africa. Illustrated; pp. 675. Price (overseas) 23s.*

THE 100-odd pages of this manual that are devoted to mining topics make it a useful source of information as to the mineral resources and projects of the two Rhodesias. Especially valuable is the section on mining laws. As the title indicates, the scope of the book includes, besides mining, all other industries, as well as agriculture, so that companies and individuals whose business affairs take them to this part of Africa, or cause them to look into the present status and future possibilities of the region, will find the volume most helpful. The editor has made it unusually comprehensive and attractive.

INDUSTRIAL PROGRESS

Numerous Electrical Devices Feature New Equipment

ELECTRICAL machinery of various types predominated in the equipment recently introduced for applications in the mining and metallurgical fields.

Brief reference was made in the *E.&M.J.* Annual Review Number, on page 133, to the new double-drum electric hoist furnished the El Potosi Mining Company, Chihuahua, Mexico, by Allis-Chalmers. This hoist is a double-drum unit, having drums 8 ft. in diameter by 6 ft. 6 in. face, and is designed for a maximum rope pull of 25,250 lb. at a maximum speed of 1,500 ft. per minute. It will wind 3,000 ft. of 1¼ in. rope in two layers. The hoist is a single-reduction geared type driven by a 700 hp., 500-volt, 425 r.p.m., d.c. motor supplied from a 600-kw. motor-generator flywheel set. The induction motor of the set is a 700-hp., 2,200-volt, 60-cycle, 3-phase machine. Brakes and clutches are oil-operated. A mechanical slow-down device of new design is incorporated in this hoist, which will automatically bring the control to the "off" position and stop the hoist if the operator fails to do so. The device is arranged to afford what is essentially semi-automatic control after the hoist has once been started by the engineer. It will also insure safe stopping at the landing when men are being handled and prevent accidental injury or killing of men in case the operator should fail to stop the hoist at the end of the trip. In addition to these features, the hoist incorporates the very latest of safety devices in its design.

The same company has also introduced a new type of multiple-arm double-disk clutch for electric hoists. In this there are no overhung members, and all pins on the larger sizes are bronze-bushed, being of the shoulder type, with castellated nuts held in position by cotter pins so that there is no chance of any nut working loose as a result of vibration. Driving is done at the outer ends of the clutch spider by means of a key instead of a pin, which the maker claims is a decided improvement. All moving pins are arranged for Zerk lubrication. The Potosi hoist described above is provided with a clutch of this type.

Synchronous Motors in Further Application

Twenty-four synchronous motors are to be installed in the concentrator of the New Cornelia Copper Company at Ajo, Ariz. Four will be used for driving Symons cone crushers and twenty for driving Marcy rod mills. The motors will be furnished by the Electric Machinery Manufacturing Company, Minneapolis. Those for the crusher drive are rated at 250 hp., 450 r.p.m. Application of motors of this type to these crushers is still comparatively new, but their suitability has been amply demonstrated. Frequency relay control, made by the Electric Machinery company, is used, and, in this instance, insures successful starting irrespective of variations in starting conditions; this control allows the motor to resynchronize if pulled out of step by excessive peak loads.

Motors for the rod mills are rated at 300 hp. and 150 r.p.m. The mills are now in use, but are to be lengthened, requiring replacement of the present synchronous motors with larger ones. The motors to be supplied are of somewhat special design to obtain the desired horsepower and temperature rating in the limited space available.

A Double-Purpose Strip Heater

Among the devices recently introduced by General Electric is a new electric strip heater which may be applied either as an air heater or as a "clamp-on" device. It is designed for general purposes where electric heat may be required and is suggested for use in cabs, valve houses, pump houses, telephone switchboards, drying ovens, oil lines, and kindred applications. The device is 24 in. long, 1½ in. wide, and ⅜ in. thick. It is rated at 500 watts at 110 or 220 volts. Slots are provided in each end, allowing the heater to be supported in air or clamped to a metal surface. Both terminals are at one end and project from the same side. The current-carrying resistance wire inside the sheath is the usual nickel-chromium resistor wound in a helix. The resistor is insulated from the sheath by magnesium oxide powder.

A Motor for Severe Conditions

Westinghouse has introduced a new fan-cooled, totally inclosed squirrel-cage induction motor, intended for use where service conditions are too severe for a standard open motor. Foundries and machine shops often present conditions which this type of motor is intended to meet. A feature of the motor is that its size is approximately the same as that of the standard open motor of equivalent rating. Its construction is almost identical to that of the latter. The stator differs only in that the ends of the windings are inclosed in sturdy, protective housings of sheet metal. The rotors are identical except for the addition of a machined steel collar on either end of the shaft. These serve to support the external cooling fans. The fan draws outside air in through the brackets at either end, and after directing it over the entire outside surface of the housing, discharges it through the middle section. The clean air, sealed in the interior of the motor, is kept in circulation by blowers on the ends of the rotor and transfers the heat generated in the windings to the protective housing, where it is dissipated by the outside cooling air. In this way, any injurious material in the outside air is unable to reach the interior of the motor. The motor is equipped with standard ball bearings, and uses the same control as any standard squirrel-cage induction motor.

Renewable Heaters for Relays

General Electric has also introduced a complete new line of double- and triple-pole temperature overload relays. The principal advantages of these are in the construction, which allows the user to remove and insert new heating elements when necessary and which permits the use of a third relay unit on the same base when protection of three legs of a circuit appears desirable. These relays are rated in current-carrying capacity from 30 to 150 amp. and are available for either front or back connecting.

Some New Switches

Two new switches have been added to its line of general-purpose starters for small d.c. motors by the same manufacturer. One is a three- and four-pole magnetic switch with self-contained "start" and "stop" stations and the other a switch for similar service, but especially designed to provide plenty of wiring space. The first is of standard design, with features for overload protection and undervoltage protection or release. It is used for starting and protecting small a.c. motors that can be thrown directly on the line. The designer and maker expect the switch to be of particular value in installations where it is desired to locate magnetic switches at the driven machines, making remote push-button control unnecessary. The second type of switch is designed for use with remote push-button stations. Its construction allows plenty of room for the arc, preventing flashovers.

The company has also introduced a complete new line of radial rheostat switches for varying the fields of large generators and motors. These are for

general application where the current is between 50 and 300 amp. There are five forms—namely, for hand, sprocket, gear, solenoid, and motor operation. Their outstanding feature is that they have renewable segments. By removing two screws any segment may be taken off without disturbing the resistor leads. Segments may be reversed for increased service.

A Compensator with High Interrupting Capacity

A new manual starting compensator, introduced by the same company, has the following features: (1) a switch design providing wide break and high interrupting capacity; (2) time-delay undervoltage release, preventing shutdown on brief power disturbances and assuring that in case of short circuit the line protective devices will open first; (3) contact tips of standard contactor construction and action, reducing maintenance cost to a minimum; (4) cabinet construction of the case for wall mounting, with ample room for ready connections and access to all parts. This compensator, it is claimed, is especially applicable to the control of high-speed, squirrel-cage motors, including all two- and most four-pole motors, particularly those driving loads of relatively high inertia and therefore taking high inrush currents and requiring considerable time to get up to speed.

Protection Against Voltage Failure After Time Interval

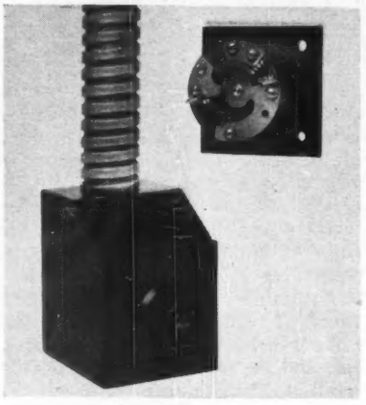
Two devices to serve as protection against failure of voltage in power circuits after a suitable interval has elapsed have also been introduced by General Electric. These are especially designed to trip the breaker in the circuit only after a suitable time interval so that interruptions to service will not be caused when momentary dips in the voltage occur. One is designed for operation in conjunction with suitable motor-operated mechanisms and is available for use on a.c. circuits only. It is especially adapted for motor and synchronous converter service where the operators desire to have the oil circuit breaker open when the voltage fails or drops below a certain per cent of normal voltage for an appreciable time. The other device is of the solenoid-and-plunger type with an air bellows for time delay. In this the time can be varied from approximately one second to one minute. The device can be applied to certain types of oil-circuit breaker operating levers.

A Controller for Fan Motors

Development of a new speed controller for slip-ring induction motors has been announced by the same company. Primarily it is intended for the control of motors driving ventilating fans, blowers and other machines where the amount of torque required decreases as the speed is reduced. The controllers provide overload and undervoltage protection and will give approximately 50 per cent speed reduction by inserting resistance in the rotor circuit. Each controller consists of a line contactor, a temperature overload relay, a secondary dial switch operated from the outside of the cover, a resistor, and a "Start-Stop" push-button station.

A Safety Push Button

The accompanying illustration shows a new safety type of push button recently developed by the Lincoln Research Laboratories. Its design is a departure from that of the usual type of push-button switch, in that it offers unusual safety features. A ball top "start" button is contained inside a large "stop" button, which projects over the former, thus protecting it from accidental contact. The "start" button can be operated only by the tip of a thumb or finger inserted inside the "stop" button. The latter can be operated by a finger or the palm of the hand. The start button is of vivid green molded Bakelite with the word "start" in white letters across the ball top face of the button. The surrounding "stop" button is of brilliant red molded Bakelite. The inner mechanism is inclosed in an arc-welded steel box. The new button is easily installed.



The "start" button of this switch is protected from accidental contact

Some Trolley Haulage Accessories

Renewable bronze cam tips, 2½ in. in size, for 6-0 round and grooved wire, have been introduced by the Ohio Brass Company, Mansfield, Ohio. These tips afford an easily renewable approach for malleable iron frogs, crossovers, and the like. The company has also introduced a 1,200-amp. automatic circuit breaker and single-pole knife switch, inclosed in an insulated case. This is a protective device for sectionalizing mine trolley and power circuits in locations such as at the entrance of each of a group of small mines working from one power house, or for an electric distribution line arrangement where a branch circuit handles current for a number of locomotives. So placed, the circuit breaker will localize power interruptions from short circuit and unreasonable overload without affecting the whole system. Although the continuous rating of this breaker is 1,200 amp., it can be adjusted to take care of momentary peak loads of 1,500 amp. As it is manually operated, the breaker stays out, on interruption of the current, until the trouble has been eliminated. Circuit breaker and hand-operated knife switch are absolutely interlocked, compelling proper sequence of operation.

Heretofore the company's so-called type of "Security" feeder wire insulator has been made to take only a 1½-in. pipe for supporting and insulating the feeder wires. It is now being furnished for use with 1¼-in. pipe. Likewise, the so-called M-3 mine section-insulator switch used for sectionalizing the trolley circuit in mines is now being made to take 6-0 round or grooved wires.

Gloves for Welders

Gauntlet gloves of a soft and pliable suede leather have been added to its line of accessories for welding and cutting by the Oxweld Acetylene Company, New York. The leather has been especially treated to prevent heat or water from affecting it. This gauntlet is close-fitting, to protect the arms. Its seams are well reinforced.

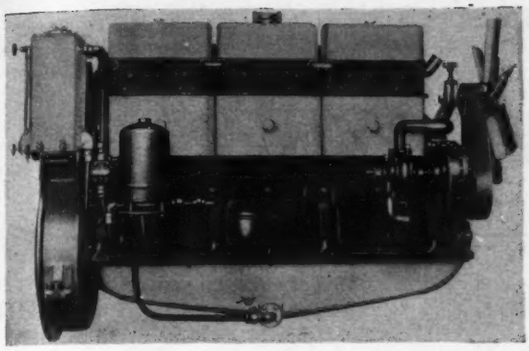
A Miniature Transformer

A reliable means of making current measurements ranging from 0.2 amp. to 200 amp. is afforded in a miniature transformer introduced by the Weston Electrical Instrument Corporation, Newark, N. J. This transformer must be used in connection with a 1-amp. a.c. instrument. It has a 1-amp. secondary and when used with a proper instrument of that range readily measures currents below 1 amp. It has four self-contained primary ranges of 2, 5, 10 and 20 amp., which are changed by means of a unique range-changing switch on the top of the instrument. It has a guaranteed accuracy of 1 per cent from 25 to 150 cycles. Ranges at 200, 100, and 50 amp. are also available by simply passing the conductor one, two or four times through the hole in the transformer provided for that purpose. This is known as an inserted primary.

Current measurements ranging from 0.2 amp. to 200 amp. are afforded in this transformer

Corrosion Resisting Alloys

Up to the present, straight iron-chromium alloys have had the greatest application where stainless steels have been desired. However, the demand for a better product has resulted in the addition of a considerable proportion of nickel to the regular stainless analysis. The valuable properties of such alloys are beginning to be realized and they are reported to be rapidly surpassing the straight iron-chromium alloys in many applications. The addition of nickel greatly increases the corrosion resistance of the alloy and provides complete immunity to many materials which attack the straight stainless irons. How-



A new Diesel engine designed on the airless fuel-injection principle

ever, mere addition of nickel to the stainless analysis itself will not produce maximum corrosion resistance. The full advantage of the addition is not obtained until the alloy has been properly processed. An improved stainless steel of this type is now being produced in this country under Krupp Nirosta patents and is known as "Enduro Nirosta" steel. Three companies are licensed to operate under these patents: the Central Alloy Steel Corporation, Massillon, Ohio; the Ludlum Steel Company, Watervliet, N. Y.; and the Babcock & Wilcox Tube Company, New York. The principal type of this new steel is being marketed as Enduro KA2. It is said to be resistant to air, water, dilute solutions and acids at high temperatures and at high pressures. It can be readily drawn, spun, machined or welded.

The rapidly expanding use of alloy steel in industry makes authoritative information on their properties of timely interest to both machinery manufacturers and large machinery users. With this in mind the International Nickel Company has prepared its so-called Nickel-Steel Bulletin No. 13, entitled "Torsion, Impact and Other Mechanical Properties of S.A.E. 3130 Nickel-Chrome Steel." This steel, the company declares, has been found to have equal or greater toughness for equal tensile strengths compared with other steels.

A New Diesel Engine

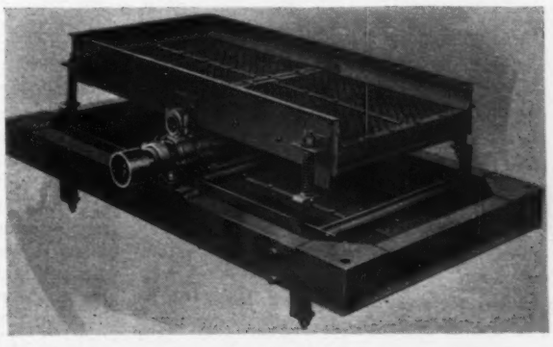
The Buda Company, of Harvey, Ill., has introduced a new 6-cylinder, 6½x8¾-in., 180-hp. full Diesel engine. In design this unit is closely related to the engine of the M.A.N. Company, of Germany, under whose license the Buda Company is operating. The engine weighs approximately 5,400 lb. and has an over-all length of 89 in. and a height of 58 in. It is designed in accordance with the airless fuel-injection principle (spray atomization). No compressed air is used for starting or running. Instead, for starting the engine uses a small air-cooled two-cylinder engine mounted on a bracket which is cast on the flywheel housing. Electric starters can be furnished if desired. Fuel consumption is said to be low. The engine uses an oil having a Baumé gravity of 26 to 38.

A Conveyor Idler for Severe Service

A new heavy-duty belt-conveyor idler, designed especially for the mining industry, has just been added to the Link-Belt Company's standard line of anti-friction idlers. It is built to withstand the severe service of handling large tonnages of heavy ores. The rolls are 8 in. diameter and are made of ⅜ in. boiler tubing. They are mounted on 1¼ in. diameter shafts with heavy tapered roller bearings. The roll ends are of malleable iron. Each roll shaft is fitted with pressure lubrication fittings, the bearings being fully protected by a labyrinth grease seal, mounted in a grease cup which also serves as an outboard reservoir and lubricates the bearing on the outside as well as on the inside. This idler may be obtained for belt widths from 30 to 60 in.

A Double-Decked Vibrating Screen

A new type of vibrating screen known as the Telsmith balanced vibrator has been introduced by the Smith Engineering Works, Milwaukee. It is double decked, and the screen surfaces move in opposite directions. The two decks are bracketed to a heavy shaft which is centrally located with respect to the frame and is equipped with roller bearings. By use of opposed eccentrics, running in ball bearings, the upper screen tray rises as the lower one goes down, and vice versa. Vigorous and uniform vibration is obtained, without dead spots on either screen. The screen is said to be fully effective, whether the load is light or heavy. By balancing the opposed movement of the two decks the vibration is confined almost entirely to the decks themselves. The steel frame of the screen receives little movement. Screen cloth is furnished in standard renewable trays, two for each deck, the cloth being mounted on a substantial steel frame. The frames are bolted to the structure of screen and the sides of the tray are protected by rubber belting. Less than 2 hp. are required for operation.



The vibration in this double-decked screen is confined largely to the decks

INDUSTRIAL NOTES

General Refractories Company has recently opened a San Francisco office at 742 Russ Building. This office is in charge of W. E. Dornbach.

Northern Equipment Company, Erie, Pa., has appointed Bradshaw & Company, 530 Fourth Ave., Pittsburgh, to represent the Copes system of boiler feed control in the Pittsburgh district. Grant D. Bradshaw is president of this newly organized firm, which is to specialize in power-plant and steel mill equipment.

H. D. Savage, president of the Combustion Corporation of America, has announced the election of Carl F. Weigel as vice-president and general manager of the subsidiary company, Hedges - Walsh - Weidner Company, Chattanooga, Tenn. Prior to the combination of the Walsh & Weidner Boiler Company and the Casey-Hedges Company, which occurred early this year, Mr. Weigel was chief engineer of the former company. Since the merger he has served as chief engineer of the combined organization.

PATENTS

Concentrating Table. No. 1,696,918. Jan. 1, 1929. Martin L. Lide, Birmingham, Ala.

Apparatus for Handling Mine Cars. No. 1,697,356. Jan. 1, 1929. Charles A. Hoover, Oskaloosa, Iowa.

Winding drum and cable method of moving cars over an inclined track.

Hollow Drill Steel. No. 1,697,086. Jan. 1, 1929. Leslie Pryce, Johannesburg, Union of South Africa.

A hollow rock drill steel having the surface of the bore through the steel formed of non-corroding material.

Flotation. No. 1,697,614. Jan. 1, 1929. Ralph E. Sayre, Mount Vernon, N. Y., assignor to Metals Recovery Company, New York, N. Y.

The patent applies to the use of a mineral collecting agent which is an organic selenium compound in which the selenium is present in a negative state.

Process for Recovering Vanadium. No. 1,696,923. Jan. 1, 1929. Ira Margie Paul, Brooklyn, N. Y., assignor to Metal & Thermit Corporation, Carteret, N. J.

This process consists of heating finely divided vanadium ore in admixture with a hydrated alkali metal sulphide till the latter first melts in its water of crystallization and then solidifies by loss of water.

NEWS OF THE WEEK

Summary

AT A recent meeting of the Utah Section of the A.I.M.E., J. S. Finlay and R. J. Corfield discussed developments at the North Lily and Utah Copper properties, respectively. Page 215.

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Increases in the Lake Shore mill, at Kirkland Lake, are expected to put that mine in second place among Canada's gold producers. The plant will have a 1,400-ton daily capacity when present additions are completed. Page 211.

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Arguments for tungsten tariff increase were presented by Nelson Franklin before the committee of the House of Representatives. China's low labor costs place American operators at disadvantage, he declared. Page 215.

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A 200-ton nickel smelter will be built by Falconbridge Nickel at its properties in the Sudbury district, where shaft-sinking is now in progress. Construction of the plant is scheduled to start May 1. Page 212.

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Arizona copper companies are installing considerable new equipment at their mines, mills, and smelters. New Cornelia is making changes which will increase its mill capacity about 20 per cent. Page 213.

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Colorado mining needs strategically located treatment plants for its complex ores, said speakers at the annual meeting of the Colorado Mining Association in Denver on Jan. 17-18. Page 214.

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Pacific Tidewater, which is connected with the British Metal Corporation, has taken an option on the Gabbo mine, on Vancouver Island, British Columbia. Page 211.

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The Mateo Mining mill, at Campo Seco, Calif., was recently completed and operations are expected to start soon. Page 214.

Howe Sound Enlarging Production From El Potosi and Sinking Shaft to 3,000 Ft.

FOR sinking to an ultimate depth of 3,000 ft. under the present program of development, Howe Sound is now installing a 750-hp. Allis-Chalmers electric hoist in the Potosi No. 1 shaft, which is the main hoisting shaft for the Potosi group of mines in the Chihuahua district, Mexico. Operations at present are bottomed at 1,850 ft. The present 450-hp. electric hoist is being transferred from the No. 1 shaft, where it was installed in 1924, to the Santo Domingo shaft, where development in the last two years has disclosed important deposits of lead-zinc sulphide ore of milling grade. It is also intended to sink the Santo Domingo shaft to an ultimate depth of 3,000 ft. for the development of additional lead-zinc ores.

The mill, originally designed for 600 tons of lead-zinc ore a day, has been built up gradually to a present daily tonnage of 1,400, and, as soon as installation of two more units of standard Minerals Separation cells has been completed, it will have a capacity of over 1,500 tons daily. Thus, no cut in the company's metal output will be made necessary by the gradual exhaustion of the Calera orebody. A year ago, the Potosi mill handled only 1,200 tons a day, the recent installation of a 5½-ft. Symons cone crusher being chiefly responsible for the increase, together with the new flotation cells. The cone crusher supplements a 48-in. Symons disk. Grinding is done in rod mills. The lead concentrate goes to the American Smelting & Refining smelter at Chihuahua. Zinc concentrate is shipped to M. Lissauer & Company, in Germany.

Howe Sound, through one of its Mexican subsidiaries, has recently taken up, by various options and agreements, 450 pertenencias in the city of Zacatecas, known as the Rafael and Eden properties. A small staff has been placed there for geological examination, surveying, pumping, and general exploratory work. Probably a year and a half will be required to complete the work. Immense dumps and old fills characterize these properties. Modern knowledge and equipment may develop something of value.

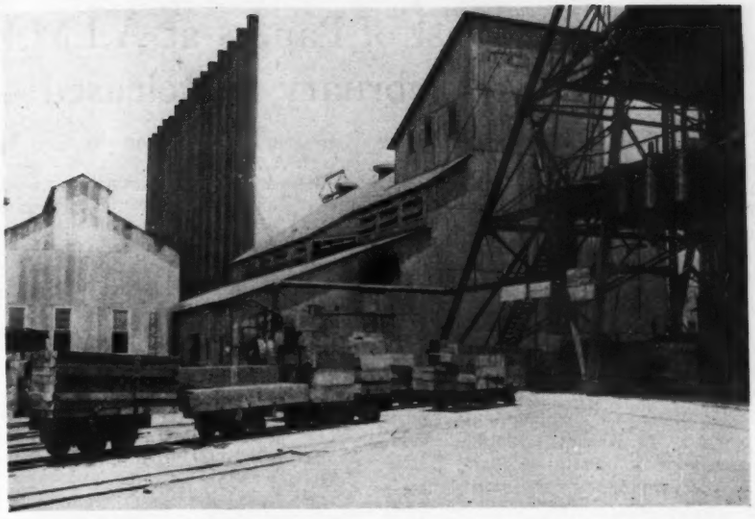
Operations at Britannia Beach continue at the same rate as has been in force for some time, the mill handling from 4,500 to 5,000 tons daily, which represents a copper production of from 3,500,000 to 4,000,000 lb. of copper per month. A shaft is being sunk 600 ft. below the 2,700 level to further determine the mineralization at depth.

Fluorspar Producers Ask for Additional Tariff Protection

APPEARING before the Ways and Means Committee recently for the fluorspar industry, G. H. Jones, president of the Hillside Mines, urged an increase in specific duty from the present rate of $7.50 per ton to $10 on all grades of fluorspar. The domestic demand can be satisfied by American mines, in the opinion of the Tariff Commission. Cheap foreign labor and trans-oceanic shipments as ballast at nominal charges, however, have been responsible for the fact that 63 per cent of the tonnage consumed comes from abroad. The number of American mines has dwindled from 151 in 1918 to 51 in 1927 and others have closed within the last year.

Of the consumption, bordering on 200,000 tons per year, 85 per cent goes into the basic open-hearth steel industry, wherein no substitute has been found, according to Mr. Jones. Other uses are in enameling, glass making, electrolytic refining of lead and the manufacture of synthetic cryolite for the reduction of bauxite. Foreign spar, though formerly inferior, is now virtually equal to the American product, and is continually being reduced in price. Since shortly after the war inflation, the American output has declined in spite of several tariff increases to keep the industry on its feet.

Subsequent to the hearing, a brief was filed by the United States Smelting Refining & Mining Company requesting that acid spar be given a separate classification. Those interested maintain that this product makes up only 6 per cent of the domestic spar production, which is not nearly adequate to fill the raw material demand for hydrofluoric acid and calcium fluoride production. On these grounds the request is presented that any duty increase apply only to flux material and not to the chemically pure acid spar. The price margin is declared to be in favor of the few American producers, whereas any large increase would seriously damage the chemical interests.



The Junction shaft of Calumet & Arizona, at Bisbee, through which the company's entire output is now hoisted, but which will be at least partly supplanted by the installation of new equipment at the Campbell shaft

Large New Electric Hoist Ordered by C. & A.

IN preparation for its recently announced development program at Bisbee, Ariz., Calumet & Arizona Mining has purchased a new $125,000 electric hoist from Allis-Chalmers. Delivery is expected in about five months. The hoist will have double drums, 10 ft. in diameter and 7 ft. 6 in. wide. It will have a maximum speed of 2,000 f.p.m. and will weigh 561,400 lb. The maximum load will be 31,300 lb. from a depth of 3,600-ft. The skips will have a capacity of 11,000 lb. each. Power will be provided for hoisting by a 1,350-hp. motor, which will have a speed of 400 r.p.m. and will receive its current from a motor-generator set. The hoisting cable will be 1⅛ in. in diameter. This hoist will be installed at the Campbell shaft, which is to be extended in depth from the present level, 2,200, to 2,500 ft.

The Campbell shaft, after it has been deepened, will be used for hoisting ore. Up to this time, the entire output from the mine has been trammed to the Junction shaft and hoisted there, but with the discovery of new, high-grade ore in the Campbell territory within the last two years, to hoist ore from the new bodies through the Campbell shaft will be more economical.

Lake Shore May Soon Be Second Only to Hollinger

PRODUCTION at the Lake Shore mine, in Kirkland Lake, is being stepped up and the mill is now treating more than 1,000 tons daily, or at the rate of over $500,000 monthly. In February another ball mill will be in operation, and the mill is then expected to have a capacity of 1,300 to 1,400 tons a day. With these additions the Lake Shore will probably take its place as the second largest gold mine in Canada, its output exceeded only by the Hollinger. Despite the increased tonnage, a drop in grade is not expected, as a large proportion of the mill feed will be taken from the No. 2 vein. On the 1,000 level a continuous stope on this vein has been opened up for 2,200 ft. and it will average over 12 ft. in width. A branch vein has also been found above the 1,000 level, and a second branch vein has been found above the 400 level, both carrying high-grade ore. On the 1,600 level, 1,800 ft. of ore has been opened in No. 2 vein. The new shaft is below 1,400 ft. and is being continued to 2,000.

Tough-Oakes Management Criticized in Report

AT THE request of the Attorney-General's department of Ontario, J. A. Reid recently examined the Tough-Oakes Burnside mine, in Kirkland Lake, regarding the operations of which there has been a great deal of criticism. Mr. Reid states that the original Tough-Oakes section appears to be definitely worked out, and, according to available information, all the ore in the mine has been removed from the workings. Development work on the lower levels, from 1,225 to 1,870 ft. deep, did not result in important ore discoveries.

The report severely criticizes the manager—Alan Stuart—and states that inspection of the mines records showed a remarkable paucity of data relating to the lower workings. No assay plans, or even recognizable assay lists, are available below the 1,025 level and the manager apparently did not have any assay plans made. However, the government will not undertake to unwater the lower levels for the purpose of examining conditions. The stockholders, however, may have this work done.

Pacific Tidewater Options Mine on Vancouver Island

PACIFIC TIDEWATER MINES, a company closely associated with the British Metal Corporation, has taken a lease and option on the controlling interest in the Gabbo group, near the mouth of the Jordan River, at the southern extremity of Vancouver Island, B. C. The agreement calls for the expenditure of not less than $200,000 in exploration and development within the next four years. If this work proves satisfactory, Pacific Tidewater agrees to take the property over for a consideration that has not been made public.

The Gabbo property adjoins the Sunloch mine, control of which is held by Consolidated Mining & Smelting of Canada, but on which Consolidated has done no appreciable amount of work for several years. Some months ago, engineers for Britannia Mining & Smelting, Howe Sound subsidiary, made an examination of the Gabbo property. Herbert Carmichael, president of Pacific Tidewater Mines, who has been in England in connection with the proposals under consideration, has left for British Columbia.

Basin Cataract Has Interesting Pumping Equipment

ONE of the most interesting pumping installations in the Montana mining field is that of the Basin Cataract Mining Company, a rehabilitation of the former Jib Consolidated Mining Company at Basin, Jefferson County, which is being reopened under the direction of W. C. Madge. The company is unwatering the East Katie shaft, which is 210 ft. deep, and has installed a Byron Jackson, seven-stage, turbine deep-well pump, which has been handling 570 g.p.m. The pump is connected by a shaft to a 50 hp. motor installed at the collar of the shaft, and, as the pump is lowered, additional sections of shaft, in 12-ft. lengths, are being connected.

The East Katie workings have considerable trouble with water, and at times the electric power is cut off. This installation has the advantage that during the power cut-off danger of drowning the motor will be obviated. Fifteen men are employed at the property, and the shaft has been unwatered to the 160-ft. point.

Douglas Will Deepen Shaft

A contract has been awarded to J. F. Johnson, mining engineer, to sink the Douglas Mining shaft, in the Coeur d'Alene district, an additional 150 ft. The shaft is now bottomed at 180 ft. below the No. 3 tunnel level. Mr. Johnson also recently obtained a contract from Bunker Hill & Sullivan to drive a mile-long tunnel which will provide a permanent operating outlet for the Big Creek and Crescent mines.

Falconbridge Nickel to Build 200-Ton Smelter

DIRECTORS of Falconbridge Nickel have decided to erect a 200-ton smelter at the company's nickel property in the Sudbury district. Construction will be started May 1. The company hopes to be able to produce 2½ per cent of the world's nickel by 1930. At present no diamond drilling is being done, but the shaft has reached a depth of 375 ft. and is being continued to 1,000 ft. About 5,000,000 tons of ore has been indicated by work done to date. The company is controlled by the Lindsley interests, which also control Sherritt-Gordon and Sudbury Basin. The last-named company has proved the length of the orebody at its Vermilion Lake property, also in Sudbury, for a distance of 1,000 ft. by diamond drilling.

Propose Pension Fund for Arizona Prospectors

SENATOR T. A. Kimball, of Graham County, has introduced a bill in the Senate of the Arizona State Legislature calling for an appropriation of $15,000 to establish a pension fund for the state's pioneer miners and prospectors. The suggested pension is $50 a month.

Under the provisions of Senator Kimball's bill, the pensions would be limited to those who have been miners or prospectors continuously during the last fifteen years, and, of these, only such persons as have resided in Arizona continuously since 1900. The pension would be granted in lieu of a membership to the Arizona Pioneers' home, in Prescott.

Speaking in behalf of his bill, Senator Kimball called attention to the fact that at the time Arizona entered statehood, a tract of 50,000 acres was set aside for a miners' home. This tract has earned $17,842.11 in rentals since that time.

Silver Summit Driving Tunnel to Cut Sunshine Vein

INSTALLATION of a new compressor has been completed at the Silver Summit tunnel, which is being developed by Stratton & Stratton, in the Coeur d'Alene district, and the work of driving the tunnel about 4,000 ft. to cut the eastern extension of the Sunshine vein, from which Sunshine Mining has been extracting high-grade silver ore for the last two years, has begun. At present the tunnel, which measures 7x8 ft., has been advanced 550 ft. The tunnel will have to cross ground belonging to the Nellie mine, but will re-enter Silver Summit territory at a distance of about 2,000 ft. from the portal. The Sunshine vein will probably be cut about 1,600 ft. below the surface. The company expects to advance about 400 ft. a month.

Preliminary List of Papers at A.I.M.E. Meeting in February Is Released

THE preliminary list of papers to be presented at the annual meeting of the A.I.M.E, which will be held in New York on Feb. 18-22, 1929, has been released and shows the usual wide range of topics covered. The preliminary announcement also includes a list of special features of the meeting, which will be the 137th held by the Institute. Awards will be presented at the annual dinner at the Waldorf-Astoria Hotel on Feb. 20 to John Hays Hammond, Saunders medal for achievement in mining; Paul D. Merica, Douglas medal for non-ferrous metallurgy; and Edgar C. Bain, Hunt medal for ferrous metallurgy. The John Fritz medal, awarded this year to Herbert Hoover, may or may not be presented at the meeting, depending on the possibility of the President-elect's finding time to attend. The smoker will be held at the Hotel Astor on Feb. 18, and the annual excursion, on Feb. 22, will be to West Point.

The ground movement and subsidence committee, and that on mining methods, will meet on Monday, Feb. 18. The mining geology committee will hold a general session on Thursday morning, Feb. 21. The committee on geophysical methods of prospecting will meet on Wednesday afternoon, Feb. 20. Two meetings will be held on Monday by the non-metallics committee. The lead and zinc committee will meet Monday morning and the milling methods committee will meet Monday afternoon. Other technical committee meetings will be made known later.

Among the papers to be presented, which will probably be of interest to *E.&M.J.* readers, are:

The Geology of Dam Sites—by Chester K. Wentworth.

More and Better Geological Data for Use in Hydraulic Projects—by G. H. Matthes.

Soapstone Mining in Virginia—by C. W. Ryan.

The Barite Industry of Missouri—by W. M. Weigel.

Government Potash Explorations in Texas and New Mexico—by G. R. Mansfield and W. B. Long.

Mineralogy of the Drill Cores Taken in Potash Drilling in Texas and New Mexico—by W. T. Schaller and E. P. Henderson.

Clay Mining for Quality—by H. E. Nold.

Indiana Oolitic Limestone; Relation of Natural Features to Commercial Grading—by G. F. Loughlin.

Occurrence of Bentonite in Southern Arkansas—by George C. Branner.

Mine Development and Underground Construction of Andes Copper Mining at Potrerillos, Chile—by I. L. Greninger.

Crushing and Grinding, II.—The Relation of Measured Surface of Crushed Quartz to Sieve Sizes—by John Gross and S. R. Zimmerley.

Crushing and Grinding, III.—Relation of Work Input to Surface Produced in Crushing Quartz—by John Gross and S. R. Zimmerley.

Copper in Cyanidation—by E. S. Leaver and J. A. Woolf.

Elements of Operation of the Pneumatic Table—by Arthur F. Taggart and R. L. Lechmere-Oertel.

The Interpretation of Gravitational Anomalies—by H. Shaw.

Theory of Adolph Schmidt's Horizontal Field Balance—by C. A. Heiland.

The Seismic Method of Mapping Geologic Structure—by D. C. Barton.

Calculations in the Interpretation of Observations with the Eötvös Torsion Balance—by D. C. Barton.

The Radioactive-Atmospheric Method of Measurement for Geophysical Prospecting—by Andrew V. Corry.

Transverse Faults at Kennecott and Their Relation to the Main Fault System—by Samuel G. Lasky.

Relation of Electrode Potentials of Some Elements to Formation of Hypogene Mineral Deposits—by B. S. Butler and W. S. Burbank.

The Extension of Oreshoots, With Comments on the Art of Ore Finding—by Harrison Schmitt.

Origin of Iron Ores of Iron Mountain and Pilot Knob, Missouri—by Joseph T. Singewald and Charles Milton.

Handling of Fine Ores and Concentrates in the Salt Lake Valley Lead Smelters—by L. D. Anderson.

Formation of Insoluble Zinc Compounds During Roasting—by H. R. Hanley, Charles Y. Clayton and David Walsh.

Lead Alloys for Anodes in the Electrolytic Production of Zinc of High Purity—by U. C. Tainton, A. G. Taylor and H. P. Ehrlinger.

High Zinc Slags in Australia—by Philip Morse.

Drop of Pressure in Air Pipes—by W. S. Weeks.

Mine Ventilation at the United Verde—by O. A. Glaeser.

Air Conditioning in Deep Mines—by R. W. Waterfill.

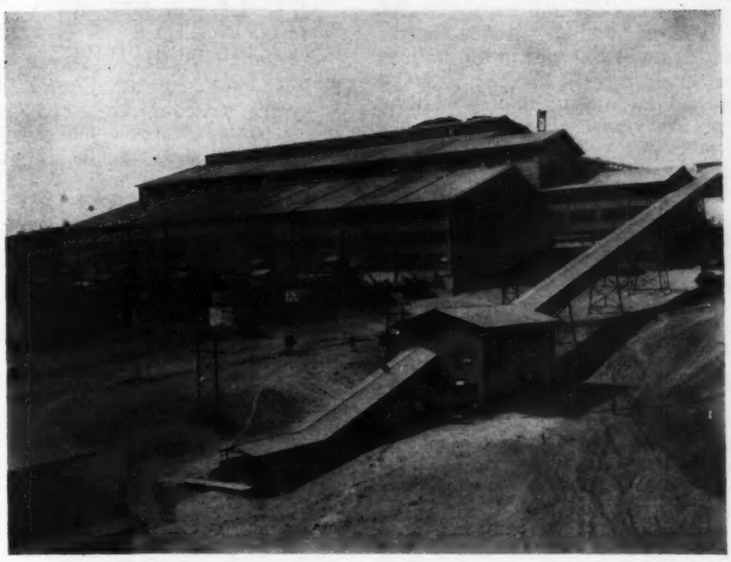
The Royal Commission on Mining Subsidence—by Henry Louis.

Subsidence From Block Caving at the Miami Mine—by F. W. Maclennan.

Granite Gold, in Alaska, Will Be Reopened

REOPENING of the old Granite Gold mine, near Port Wells, Alaska, will be undertaken this spring by the present owner, L. H. Carver, of Seattle, Wash. A hydro-electric plant will be installed to provide the necessary power. This property was operated prior to the war, and had a total production of $277,000. It was operated by a Seattle company, Granite Gold Mining. About $330,000 was spent in development work, which included sinking a 200-ft. incline shaft. Total deveopment work was over 5,000 feet.

A small ten-stamp mill was used to treat the ore. Production was at the rate of about 70 tons daily just prior to the shutdown, which was caused by high cost of materials and labor. The total extent of the holdings is about 60 acres.



The New Cornelia concentrator at Ajo, Ariz., now being remodeled to increase its capacity 20 per cent. In 1927 it treated an average of 6,350 tons daily.

Arizona Mines Installing Much New Equipment

AS A result of higher copper prices, many of the Arizona mines are installing new equipment whereby they will increase their producing capacity and meet the increased demand for the metal. Probably the most important changes are being made at the New Cornelia sulphide ore mill, which will be increased by about 20 per cent in capacity. Miami, Copper Queen, Inspiration, Calumet & Arizona, and Morenci are also making changes in equipment.

At the Ajo plant of New Cornelia, a 7-ft. Symons cone crusher is now in service, and three additional crushers of the same type are being installed. The 48-in. Symons disk crushers will be eliminated and 4-mesh screens installed for closed-circuit operation with the rolls. A minus-4-mesh product will be sent to the rod mills, which will be lengthened from 12 to 15 ft. by means of 18-in. rings on either end. Twenty-four new motors, all of the synchronous type, will be installed, four for the cone crushers and twenty for the Marcy rod mills. Motors for the cone crusher drive are rated at 250 hp., 450 r.p.m., and motors for the rod mills are 300 hp., 150 r.p.m. Motors of a design to obtain the necessary horsepower and temperature rating in the limited space available are being supplied. The old oxide crushing plant is to be tied in to the sulphide crushing plant, thus making the coarse-crushing equipment more elastic and providing ample capacity.

At Morenci, two Symons cone crushers are being installed to replace the rolls and Symons disk crushers that follow the gyratory crusher, which now receives the product of the primary jaw crusher.

At Miami, Miami Copper has added one 7-ft. cone crusher and it is understood that another is also to be installed. The Newhouse suspended type gyratory crusher is to be retained. At the Inspiration concentrator, a 7-ft. cone crusher has been installed and will be tried out. The mill is being rapidly brought up to capacity.

A new crushing and sampling mill and bedding system is being planned at the Copper Queen smelter, Douglas, Ariz. Several layouts have been made and are being considered. A circular casting machine and a skull breaker are being installed at the neighboring Calumet & Arizona smelter. At Bisbee, rearrangement of surface equipment at the Sacramento shaft of the Copper Queen mine is under way.

Union Extension Starts to Deepen Shaft Near Phoenix

THE work of deepening the shaft of the Union Extension mine, 20 miles north of Phoenix, Ariz., is being done by Lem Stallings, of Bisbee, on contract. Work on the property was started about a year ago when the shaft was sunk to the 100 level and some crosscutting done. The crosscuts intersected two fissure veins in which high-grade gold ore was reported. Stallings is to deepen the shaft to 500 ft., and crosscutting will then be done at that level. The property is financed by Bisbee men. W. A. Robinson is president, William E. Oxsheer is secretary-treasurer, and Harold Thomas is in charge of the development operations.

The Union Extension property is near the Jack White mine, where a high-grade strike has just been reported. It is said that a drift on the 300 level has struck a 12-ft. vein. The property is equipped with a ten-stamp mill, capable of handling 50 tons per day. As a result of a recent test run, gold worth $685.73 was recovered. The Jack White is an old mine, but most of the work on it has been done in the last two years.

Arizona Mines Had Only 29 Fatal Accidents in 1928

ACCORDING to the seventeenth annual report issued by Tom C. Foster, Arizona state mine inspector, only 29 fatal accidents occurred in Arizona mines during 1928. This figure compares with totals of from 40 to 45 deaths for the years immediately preceding 1928. At the close of 1928 11,624 men were employed in the 121 mines of the state. Of these 8,623 were employed underground and 2,941 on surface. The report gives the names of the operating mines, their managers, the number of men employed, the character of the ore, and the tonnage produced each month. The report also lists the serious and minor accidents in each mine in addition to the fatal accidents. Non-fatal accidents in Arizona mines during the year totaled 555.

Final figures of the 1928 safety contest among the four units of the Phelps Dodge corporation show that the Morenci branch, with only sixteen time-lost accidents, took first place. This branch had a rating of .042, figured on the basis of each 1,000 shifts worked. The Nacozari branch, employing a much larger force of men, ran a close second, with a record of 27 accidents. Its rating was .044. The Copper Queen branch had a rating of .089 and the Old Dominion .067. By taking first place the Morenci branch receives the James S. Douglas Safety Trophy for the year.

Use of Flotation Successful at Champion Mill

COPPER RANGE is meeting with success in flotation tests in the Champion mill. One Fahrenwald machine and two others which were installed before the Fahrenwald machine was introduced in the Michigan copper district are in operation. In each case, the reagent is sodium xanthate. The richness of the concentrate in copper and the fact that Copper Range is regrinding all ore make for a high recovery—considerably better than that of other amygdaloid mines in the district. With the completion of the experimental period, the mill will be equipped for the treatment of practically the entire tonnage by flotation.

Miami Commercial Company Rebates $65,646 to Workers

Rebate checks aggregating $65,646, representing the profits of the Miami Commercial Company for the last six months of 1928, have been distributed to employees of that organization, the Miami-Inspiration Hospital, and Miami Copper Company. The Commercial company operates a general store which is owned by the Miami Copper Company. Profits are distributed among the employees in proportion to their total purchases.

Need for Treatment Plants Shown at Colorado Meeting

THAT Colorado mining needs strategically located treatment plants for its complex ores was shown by several speakers at the annual meeting of the Colorado Mining Association and the Colorado chapter of the American Mining Congress, held in the Continental Oil Company's building in Denver on Jan. 16 and 17. The cost of transportation from most of the districts to the existing plants is said to be retarding the development of the state's mines.

A committee which was appointed last year to investigate the need of a smelter in Denver reported that conditions justified such facilities. W. E. Greenawalt and E. W. Keith discussed the possibilities of erecting an electrolytic zinc plant in Colorado. At present most of the state's zinc ores, the greater part of which are extracted from the San Juan basin districts, are sent to Oklahoma and Texas zinc smelters.

Dr. G. F. Loughlin and Prof. B. S. Butler, of the U. S. Geological Survey, stated that 55,000 square miles in the State of Colorado have been mapped topographically by the survey, of which three-fifths was east of the main range of the Rocky Mountains. New maps of several important mining districts, including Breckenridge, Creede, Central City, Idaho Springs, Alma, Bonanza, Ouray, and Telluride, have been prepared from the data obtained. In the opinion of the speakers, several of the old mining districts are still potential producers, if the capital and development work necessary are forthcoming.

Other speakers included John T. Joyce, State Commissioner of Mines, who spoke on "Mining Resources of Colorado," which he declared were ample; Jesse F. McDonald, president of the Colorado Mining Association, who told of some of his experiences and who also commented on the possibilities of 1929; Stuart Croasdale, who gave an address on "The Value of Research in Developing the Mining Industry"; Congressman W. R. Eaton, who spoke on the "Metallic Basis of Value," and Fred Farrar, general counsel of Colorado Fuel & Iron, who dwelt on "Compensation Insurance."

J. O. A. Carper was toastmaster at the annual "Sowbelly Dinner," which was very well attended. Music was furnished by the Colorado School of Mines band. It may be mentioned, in passing, that not a single dish was broken during the evening. They were made of tin.

Hirst-Chichagof Mining Increases Mill Capacity

HIRST-CHICHAGOF MINING, of Seattle, is arranging to double the capacity of its mill on Chichagof Island, Alaska. The necessary machinery has been purchased. A transmission line will be constructed to connect the mine with the power plant of Chichagof Gold Mining, with which arrangements have been made for the supply of 200 hp. Plans in prospect provide for the re-treating of 25,000 tons of old tailings on the dump. These average $6 a ton in gold. The company is also working three parallel veins. The main vein has been developed to a depth of 500 ft. on the best ore yet found on the property. Ore reserves are sufficient for two years' operation. Experiments are being made with flotation by which it is expected a recovery of 96 per cent of the metal content can be made.

Develop Three Claims Near Como District of Nevada

A PORTABLE compressor has been shipped to a group of three claims east of the Como district, in Nevada, now owned by Pony Meadows Mining and development of the claims, on which D. F. Meiklejohn recently struck some comparatively high-grade gold ore, will be pushed, according to H. C. Haas, of San Francisco, who was recently interviewed by a representative of *Engineering and Mining Journal*.

Como was a large town in the early days, and was the county seat of Lyon County. However, in 1874 the mines were abandoned and subsequent efforts to work them were failures, partly as a result of faulty metallurgy. In 1924, Mr. Meiklejohn located the claims. Recently a few holes were drilled in the outcrops and rich ore was exposed. The old workings were cleaned out and trenches cut across the outcrop.

At present the company plans to ship about 100 tons of ore. Other plans include the erection of a 50-ton mill, with amalgamation equipment. Preparations are being made to sink a 400-ft. two-compartment shaft, and to explore at depth.

Reopen Ruby Gulch Mine, Phillips County, Mont.

OWEN BYRNES, of Helena, and associates have reopened the famous Ruby Gulch mine, at Zortman, Phillips County, Mont., and will build a new mill to treat the gold ores of the property. Until the war the property produced about 850 tons of gold ore per day, assaying around $2.50 per ton. This was treated at a cyanide leaching plant, the ore being crushed to $\frac{3}{8}$-in. mesh.

Copper Companies Help to Rebuild Chilean School

Andes Copper Mining and Chile Exploration, American copper-mining companies operating in Chile, have offered the Chilean government 50,000 Chilean pesos each, to be used in rebuilding the School of Mines at Copiapo, which was destroyed by fire on Jan. 8. This was the oldest school of its sort in South America, and the damage was estimated at about 1,000,000 pesos, approximately $125,000 in U. S. currency. A valuable collection of minerals was destroyed.

New Mateo Mining Mill Is Completed

THE 100-ton flotation mill erected by the Mateo Mining Company at Campo Seco, Calif., on the property formerly held by the Penn Mining Company, has been completed and will soon be placed in operation. The equipment consists of a coarse crusher, conveyor, fine crusher, Hardinge ball mill in closed circuit with a Dorr duplex classifier, a 14-cell, 15-in. sub-A flotation machine, Wilfley tables, 24x7-ft. Dorr thickener, and a 6-ft. American type filter. All units are motor driven, current being purchased from the Pacific Gas & Electric Company. Preliminary testing work indicates that four products will be made: copper concentrates, 26 per cent copper; zinc concentrates, 52 per cent zinc; lead concentrates, 40 per cent lead; and iron-pyrite product containing 48 per cent sulphur and $12 gold per ton.

Ore supply is derived from the mine at Campo Seco. This property was operated by Penn Mining for nineteen years up to 1926, when the low price of copper and the increasing percentage of zinc made it no longer profitable by methods at that time in use. The plant consisted of crushing and grinding equipment, multiple-hearth roasters, a reverberatory smelting furnace, and a converter. Blister copper was shipped to Eastern refineries. Development work in the mine was maintained well in advance of requirements, and when the mine was shut down there was a reserve of about 200,000 tons of ore carrying 3.2 per cent copper, 12 per cent zinc, 0.8 per cent lead, 3.6 oz. silver and $1.60 in gold per ton.

In July, 1928, T. J. Jones, formerly consulting engineer of Russo-Asiatic Consolidated, of London, and his associates, acquired the property and incorporated as Mateo Mining. The mine has been rehabilitated and unwatered to the 700 level.

Granby Wins Right to Appeal in Kootenay Power Suit

THE British Columbia Court of Appeals has granted Granby Consolidated leave to appeal to the judicial committee of the Privy Council against its dismissal of mandamus proceedings, taken last October, against West Kootenay Power & Light, to compel the latter not to interrupt the supply of electric energy to Granby's Copper Mountain mine and Allenby concentrator. Permission was granted on the proviso that Granby pay a higher rate for power than that which had been in effect. The new rate was fixed at $1.05 per kilowatt while the price of copper remained above 15½c. per pound. The rate under the old contract, which expired Aug. 31, 1927, was 75c. per kilowatt. The court refused the application of council for Consolidated Mining & Smelting, which controls West Kootenay, to have the new rate made retroactive from Sept. 1 last.

Finlay Tells Story of Development of North Lily Into a Dividend Payer

Co-operation With Other Companies Helped to Cut Costs, He Declares at Utah Meeting—Corfield Discusses the Electrification of Bingham Mine of Utah Copper

OPERATING problems at two leading Utah mines—the North Lily, in the Tintic district, and Utah Copper, at Bingham—were discussed by J. S. Finlay, superintendent of North Lily Mining, an International Smelting subsidiary, and R. J. Corfield, electrical engineer of Utah Copper, before a recent meeting of the Utah Section of the A.I.M.E. at the Newhouse Hotel, Salt Lake City. In the absence of J. M. Boutwell, J. A. Norden, vice-chairman of the section, presided.

"The North Lily mine," said Mr. Finlay, in introducing his subject, "started its career in an unusual way. It was discovered by a geologist. At a cost of $26,000, a drift was run 2,600 ft. from the Tintic Standard 700 level, and the orebody hit square on the nose, proving that even the Lord sometimes loves a geologist." At present, Mr. Finlay said, the mine was shipping 6,000 tons of silver-lead ore monthly, which is netting a profit of $100,000, after depletion and taxes. Since its discovery in January, 1927, the mine has produced about 76,000 tons of ore.

A four-compartment shaft was sunk so that operations could be carried on from the single shaft by several companies, the speaker declared. By this co-operation, North Lily, Tintic Standard, and Chief Consolidated—all operating in contiguous territory—are able to operate at much lower costs than if each company worked through its own shaft.

North Lily costs range from $3.50 to $4.50 a ton. Tramming the ore over the company's 3,000-ft. tramway to the Dividend loading station, including labor at the terminal and hauling supplies back to the mine, costs 21c. a ton. The company is doing 1,000 ft. of development work monthly and holds to the "ton-for-ton" basis. Development costs per ton of ore mined are $1.75.

The orebody, Mr. Finlay explained, occurs as a replacement of the Ophir shales and limestones. It is 650 ft. long on the strike. The grade is high and but little sorting has to be done, as there is no waste. An interesting development has been the exposure of considerable ore in the Cambrian quartzite to the north and south of the main orebody. By following the ore in the fissure, good stopes of carbonate are opened up in the quartzite.

Electric haulage underground, supplied by Mancha storage-battery locomotives, is effecting a saving of $60 a day over haulage by mules. Edison storage batteries are used. This type of haulage also allows better sanitary conditions and reduces the fire hazard. Twelve-pound rails are used. As many as 30 cars are hauled to the trip, at a speed of 6 miles per hour. The length of some hauls at the North Lily is as great as 1,500 ft.

Mr. Corfield dwelt on details of the various devices developed at Bingham recently to convey power to the newly installed electric locomotives. A point developed by subsequent discussion was that the storage-battery feature of these locomotives, combining the conventional pantograph, cable reel, side-arm trolleys, and storage battery, is to be eliminated in the future. Eighteen of the second unit of twenty locomotives recently ordered from General Electric are to have no storage-battery attachment, because of the higher maintenance cost and a belief that locomotives combining pantograph, cable reel, and trolleys will be better able to meet all demands.

No data as to the superior economy of electric haulage over steam at the Utah Copper have yet been completed, but members of the staff believe that electric locomotives will cut the haulage cost in half, or from 6c. a ton to 3c.

Electric haulage has already accomplished three things, said Mr. Corfield. Firemen and watchmen have been eliminated. Coal and water stations are no longer needed. Greater speed and increased capacity has been provided. Smoke has been banished, giving better visibility and making for greater safety. Though steam locomotives are still being used to haul ore from the collecting yard at Bingham to the mills at Magna and Arthur, it was hinted that when the electrification of the mine is completed, electrification of the Bingham and Garfield railroad will probably follow.

Overhead wiring at the Utah Copper mine, said Mr. Corfield, presented new and difficult problems. Open-cut mining necessitated constant shifting of trackage and poles on the levels. To meet this condition several methods have been devised. On abrupt curves, poles are put on the bank side and provided with unusually long bracket arms, to which the trolley wire is attached. Over bridges, an I-beam structure with 4-in. I-beam poles, 150 ft. apart, and corner stiffeners, have been found satisfactory. On the levels, one type of pole had been devised by setting 4-in. pipe, 22 ft. long, with a long side arm in a concrete base which can be moved or pulled about like a stone boat. Recently, it has been found more practical to supplant this procedure by fastening 10-ft. bracket arms on the portable transmission towers carrying the feeder line for the electric shovel. The trolley wire attached to the long bracket arm on portable transmission towers is operating satisfactorily.

On the dump track, the trolley pole is bolted between two 20-ft. bridge timbers. Head guys are used to stabilize them.

Committee Hears Arguments for a Tungsten Tariff Increase

ARGUMENTS for a tariff increase on tungsten have been presented to the House Committee by Nelson Franklin, of Washington, D. C., representing American mining interests. He maintained that domestic production had increased after the tariff act of 1922 as the surplus imported from China and on hand at United States ports became exhausted. For the last three years, however, the American output has decreased as China came back into the market and forced domestic operators out of business. Mr. Franklin stated that the domestic demand of 4,000 tons of 60 per cent concentrate could be entirely satisfied in this country under protection, basing his statement on the war-time output of 6,000 tons, attained when emergency demand built up the industry. China's low labor costs and the fact that her large deposits permit surface mining are the principal factors in placing American operators at a disadvantage. South America is no longer a source of competition. To bring about an equalization of costs, a duty increase of 50 per cent was advocated, a raise from 45c. to 67½c. per pound of metallic content of the ore or concentrate.

In questioning the witness, Representative Hull, of Tennessee, mentioned that the annual cost of tungsten to the iron and steel industry stands at about $7,000,000 per year under present assessments. He also pointed out that the duty, which now approximates 192 per cent ad valorem, would be as much as 250 per cent or more if the rates are raised.

Testimony by other witnesses was directed at importation of scrap tungsten steel, which, it was claimed, is equivalent to ferrotungsten, but which comes in at a much lower rate as scrap steel. In other words, one of the two commodities which are used for the same commercial purpose pays 71c. a pound, whereas the other is assessed at one one-hundredth of that amount. Correction of the wording to close this loophole was requested. The suggestion was advanced that this apply also to molybdenum, which was discussed briefly by Mr. Franklin as a sister metal to tungsten. No duty increase was asked for molybdenum.

Real del Monte to Diamond Drill at Guanajuato

Real del Monte, U. S. Smelting, Refining & Mining subsidiary, recently shipped diamond-drilling apparatus to Guanajuato, where work is to be started immediately in an effort to determine the extent of the recently discovered fault on the Mother Lode. Real del Monte has acquired a lease on the claims covering most of the territory involved.

California Decreased Output of Major Metals in 1928

ESTIMATED value of gold, silver, copper, and lead produced in California in 1928 was $15,470,000, according to compilation of the U. S. Bureau of Mines. Compared with 1927, this is a decrease of $1,361,000, or 8 per cent, but in this decline there is a value of $516,008 for zinc produced in 1927. No zinc mines were operated in 1928. All metals showed decreases in the quantities produced, and in only one instance did the value of the metals increase—namely, copper, caused by the increase in the price of the metal, compared with 1927. Gold production is estimated at 524,300 oz., valued at $10,838,000, compared with 564,586 oz., valued at $11,671,018, in 1927, a decrease of 7 per cent from 1927. The silver yield is estimated at 1,504,000 oz., valued at $880,000, compared with 1,620,242 oz., valued at $918,677, in 1927, a decrease of 7 per cent in quantity and of 4 per cent in value. Production of copper in 1928 is estimated at 25,000,000 lb., valued at $3,650,000, compared with 27,133,008 lb., valued at $3,554,424, in 1927, which is a decrease of 8 per cent in quantity and an increase of 3 per cent in value. The output of lead in 1928 is estimated at 1,676,000 lb., valued at $102,000, compared with 2,718,014 lb., valued at $171,235, in 1927, a decrease of 38 per cent in quantity and 40 per cent in value.

Placer mining about Cecilville and Fort Jones, Siskiyou County, was carried on, but shortage of water closed the mill at the Bonanza property, near Forks of Salmon, in June. In Trinity County, the Island Mountain copper mine operated steadily. The Lewiston and Trinity dredges were working. Madrona Dredging contemplates operation of its newly built dredge early in 1929. McNamara Mining & Milling completed a 10-mile road to the Nash mine, on Coffee Creek, for the reopening of that property, and Vancouver capital took over the Pat Holland claims near Carrville. Large holdings on Duttons Creek were transferred under option to the Fortuna Company, a Nevada corporation, and hydraulic operations were expected to begin in April, 1929. Mountain Copper recovered copper at its leaching plant at Martinez and also shipped sulphide ore from its Shasta County property; plans were considered late in the year for the operation of its No. 8 mine in 1929. Mason Valley Mines ceased operations at the Balaklala copper mine in June and the Afterthought remained closed throughout the year. The Niagara gold mine, near French Gulch, was developed.

In Sierra County the Original Sixteen-to-One mine was again the largest producer. A mill was installed at the Oro property, near Downieville, and the Finney mine was further developed. Alleghany-El Dorado Gold Mining was being financed to extend operations at its property on Kanaka Creek. Walker and Engels, copper mines in Plumas County, operated normally, and further exploration work at both properties was encouraging. Enlarged milling capacity for the Walker mine is expected for 1929. Genii Mining continued tunneling at its property one mile southeast of Magalia, Butte County.

In Nevada County the Empire, Idaho-Maryland, and North Star reported encouraging results from development at lower levels. Rescue-Eula Mining prepared for underground mining at the Gaston mine, idle for about ten years, and Yellow Tiger Consolidated planned consistent production from the Ancho property. Other prominent mines in the county were the Boundary, Golden Center, Kennebec, Murchie, Twin Sister, and Western Merger. Litigation closed the Three Queens property in Placer County—a producer in 1927.

Hammon Engineering, operating dredges near Hammonton, Yuba County, was again the largest gold producer in the state. Red Cross Mining developed its property near Dobbins. In Sacramento County, Natomas had a normal dredge yield and the Channel Mining began production at its drift property in the Blue Ravine district. The La Grange dredge, in Stanislaus County, continued operations throughout the year.

In Eldorado County, the Blue Channel, Kelsey, Manhattan, Paymaster, and Sliger mines were all productive. Parnall Gold Mining installed a mill at the Avasino property, 20 miles east of Placerville, and the Woodside-Eureka property, near Georgetown, was reopened. Development at the Argonaut, Central Eureka, and Kennedy mines, Amador County, showed good ore at deeper levels and the mines produced as much as if not more than in 1927. The Kennedy's output, however, was stopped in September as a result of destruction of surface equipment by fire. Moore Mining continued production and development. Lopez Mining & Milling Corporation developed the old Big and Little Spanish property, four miles north of Plymouth, and the Henry mine was taken over by new interests and shaft-sinking begun.

In Calaveras County many small mines were exploited, and the old Royal property, near Hodson, was rejuvenated by Royal Development. Plans for consolidation of properties in Mariposa County were reported. The Colorado, idle for ten years, was reopened by Belmont Metals, and Nevada Hills Mining carried on its development campaign at the Virginia. Work was started on the six months' development program for the Feliciana, near Briceburg.

Prospecting in Tuolumne County was stimulated in the late summer by the finding of a rich pocket on the Mark Twain Mining property near Tuttletown, which yielded over 400 oz. of bullion. Live Oak Mining installed a mill at the Mexican mine, and the Oak Hill property in the southwestern part of the county was equipped with machinery and power.

In Inyo County the Cerro Gordo and Estelle mines were not operated during the first ten months of the year, but litigation between these companies was settled out of court and Estelle Mining began shipping lead-silver ore from the Despresiada orebody in November. The U. S. Smelting Refining & Mining shipped from the Santa Rosa property, and lessees shipped lead ore from the Copper Queen. In the Ubehebe district the Butte (Farrington-Watterson) mine was a large producer of lead. In Kern County much prospecting and diamond drilling was carried on at the Big Blue mine, near Kernville. Lessees worked the Standard for part of the year, milling its ore at the Tropico plant. The King Solomon and the Yellow Aster mines produced, and Yellow Aster tailing was treated in a 100-ton cyanide plant. California Rand Silver continued diamond drilling and drifting at its property near Randsburg, San Bernardino County, and shipped silver concentrate. Copper ore was shipped from the Von Trigger property, near Goffs, and lead concentrates from the Carbonate King, at Nipton. Black Eagle further developed its property near Mecca, Riverside County, and shipped lead-copper ore.

Washington Production Dropped in 1928

GOLD, silver, copper, lead, and zinc produced in Washington in 1928 was valued at about $626,000, compared with $854,659 in 1927, according to estimates by the U. S. Bureau of Mines. Production of gold decreased from $403,380 in 1927 to $334,000 in 1928. Output of gold and silver in the Republic district, which produced nearly all the gold in the state, decreased from $376,932 in 1927 to about $285,000 in 1928. The Quilp mine, which increased its output, was the largest gold producer, followed by the group operated by Aurum Mining, formerly owned by Northport Smelting & Refining. The Last Chance mine, of the Lone-Pine Surprise Consolidated, and the Insurgent property, under lease, were also large producers, but their output was much less than that of 1927. Boundary Red Mountain Mining, south of Sardis, B. C., was the third largest producer of gold in Washington, although output decreased. Some placer mining was done at Liberty, but Kittitas Gold Mining dredge was not operated regularly.

Silver output decreased from 155,850 oz. in 1927 to about 94,000 oz. in 1928. The Republic district produced most of it. Output of copper decreased from 1,685,848 lb. in 1927 to 1,121,000 lb. in 1928, and the value from $220,846 to $163,000. Sunset Copper, near Index, the largest producer in the state, ran its mill regularly, but made fewer shipments of concentrate. Other producers were Chewelah Union, at Chewelah, and the Turk mine, operated by the Snowdrift Mining. A mill was constructed at the Turk mine late in 1927, but operated only a short time in 1928.

Royal Development continued a campaign of vigorous development work.

Lead output increased from 95,003 lb., valued at $60,165, in 1927, to about 1,180,000 lb., valued at $72,000, in 1928. The Gladstone mine, near Northport, was the largest producer in 1928, but the output was small compared with its former records. Other producers were Electric Point, near Northport; Young America, near Marcus; the Silver Queen, at Springdale; Boundary Silver-Lead, at Boundary; and the Red Top, near Northport.

Production of zinc decreased from 1,279,710 lb. in 1927 to about 26,000 lb. in 1928, as a result of the idleness of the mills at Metaline Falls and Northport. No shipments of concentrate were made from either the Black Rock or Pend Oreille mines, both large producers in 1927. One car of crude lead-zinc ore was shipped from the Great Western mine, near Northport. A new mill was constructed for the Grandview mine and considerable work done in developing lead-zinc ore at Metaline Falls, in Pend Oreille County.

Colorado Production Shows Small Decrease in 1928

ESTIMATED output from Colorado mines in 1928 was 253,644 oz. of gold, 4,131,465 oz. of silver, 8,119,000 lb. of copper, 54,036,000 lb. of lead, and 65,203,000 lb. of zinc, according to the U. S. Bureau of Mines. Compared with 1927 figures, gold shows a decrease of $35,831, silver an increase of 346,860 oz., copper an increase of 2,448,419 lb., lead a decrease of 12,736,557 lb., and zinc a decrease of 6,526,000 lb. The estimated value of the metal output in 1928 is gold $5,243,287, silver $2,416,907, copper $1,185,374, lead $3,296,196, zinc $3,912,180, or a total of $16,053,944, compared with $16,965,162 in 1927.

The Cripple Creek district in 1928 produced $3,098,212 in gold, as compared with $3,307,505 in 1927. This decrease is explained by the fact that the grade of ore mined was much lower in average content, though the tonnage was greater. Cresson, in particular, produced nearly 30,000 tons of ore more than in 1927, but the grade of ore in 1928 averaged about $3.80 a ton less than in 1927. The Portland-Independence mill, at Victor, was closed down Dec. 1, 1928. Production was steady from the various properties of United Gold Mines. Other producing properties were the Blue Bird, Dante, Elkton, El Paso, Empire Lee, Forest Queen, Gold Pinnacle, Granite, Index, McKinney, Midget, Queen, and Stratton Lease.

At Leadville, only one furnace was in blast at the Arkansas Valley smelter. The Colorado Zinc-Lead selective flotation mill was operated continuously. The lead-zinc-silver-sulphide ore treated at this mill came chiefly from Leadville Deep Mines, in the Carbonate Hill-Graham Park area. Lead-silver and iron-silver sulphide ores were also shipped by Leadville Deep Mines to the A. V. smelter and zinc-lead sulphide ore to the Ozark zinc-lead pigment plant at Coffeyville, Kan. Zinc-lead sulphide and other ores were shipped by Evans-Wallower from the Henriett-Maid of Erin. Lessees on the Ibex and Golden Eagle mines continued to ship pyritic and siliceous gold ores to the smelter and to the Golden Cycle mill. In all, about 25 mines in the Leadville district in 1928 yielded a total value for the five metals of $2,912,017, an increase of $37,901 over the record of 1927.

At Climax, on Fremont Pass, the Climax Molybdenum flotation mill was operated continuously, gradually increasing from 25,000 tons a month in January to 30,000 tons a month in December.

The Sunnyside selective flotation mill, at Eureka, was operated continuously, its tonnage at the beginning of the year being 800 tons a day and 1,000 tons a day at the end. Development work on the Mayflower group of the Shenandoah-Dives-North Star-Mayflower enterprise opened sufficient ore to send to the Iowa-Tiger gravity concentration mill, and later to warrant the remodeling of this mill, which included the addition of flotation machines. The new Lackawanna 50-ton flotation mill was set in operation in November. International's selective flotation mill, at Rico, closed in August, 1928, but production of lead-zinc-iron-silver ore continued throughout the year, crude ore being shipped to the Midvale, Utah, selective flotation mill.

The 325-ton Rawley flotation mill, at Bonanza, was operated continuously. With the increase in the price of copper, attention was directed to the copper constituent of the Rawley vein, with a resultant increase of copper output and less lead than in 1927. Production of high-grade gold ore, first opened in 1926, continued in 1928 from the Little Annie mine, at Summitville.

San Miguel County mines, with the Tomboy mine and mill idle since February, 1927, the Black Bear and San Bernardo idle in 1928, and the Smuggler Union mine and mill at reduced capacity since the fire at the Pennsylvania adit in November, 1927, yielded a gross value of $1,370,797, compared with $2,118,333 in 1927. The Carbonero mill, at Ophir, and the new Butterfly-Terrible mill, at Ophir, were operated in 1928. Producing mines in La Plata County were the May Day and the Gold King. Production of gold ore from the Jonathan mine, at Ouray, and of copper-silver-gold ore at the San Antonio mine, at Red Mountain, which was treated at the Camp Bird mill, increased Ouray County's gold output. Development work was done at the Hidden Treasure mine.

Shipments of zinc-lead-silver-iron ore from the Akron mine, in Gunnison County, were resumed in August, and continued throughout the rest of the year. The Carter mill, at Ohio, was operated for a period, and lead-silver ore was shipped from the Star-Independent mine, on Italian Mountain.

Shipments of lead-silver ore from Aspen were dependent on the Arkansas Valley smelter's needs, and were therefore less than in 1927. At Rifle, the 140-ton roasting and leaching plant of the United States Vanadium Corporation was operated steadily.

At Gilman, shipments of zinc-lead-silver-iron ore from the Empire Zinc mine to the company's magnetic separation plant at Canon City ceased in October, 1927, pending perfection of plans for a mill at Belden. In July, excavation for an underground flotation mill to be ready for operation May 1, 1929, was begun. Throughout 1928, iron-silver-gold ore and copper-silver-gold ore were shipped to the Murray and Garfield plants, Utah. The Canon City magnetic separation plant was closed down, but the oxide plant, also at Canon City, was operated on zinc sulphide concentrates from the company's mill, at Hanover, N. M.

At Breckenridge, the Wellington flotation mill was set in operation in July and continued throughout the rest of the year to yield zinc and lead concentrates. The Blue River dredge was operated until October.

The new ventilation and operating raise at the London mine was completed in July, and thereafter gold ore was shipped to Leadville and to Colorado Springs.

Resumption during the summer of the milling of dump ores at the East Butte flotation mill, at Silver Plume, and continuation until Nov. 30, added greatly to Clear Creek County's silver production. Gold Dirt's mill, at Empire, yielded gold concentrate. The mill at the mouth of the Argo adit was remodeled and operated on ores from the Concrete, Ophir, and Phoenix mines, Gilpin County, resulting in an increased production. Production of gold-silver-lead concentrate from the Boulder County mill, at Cardinal, and of gold bullion from the Wood Mountain mill, at Sugar Loaf, added to small lots from other districts in Boulder County, resulted in a small increase in total production for that county. The mill of the Terrible mine, at Ilse, Custer County, was idle all the year, but development work was done until fire destroyed the hoist, compressor, and shaft house, in November, 1928.

San Francisco Section Meets

On Jan. 8, 1929, the San Francisco Section of the A.I.M.E. held its regular meeting. Conservation of natural resources was the subject of the evening. F. H. Probert presented a paper on "Control of Mineral Products for the Public Welfare." M. E. Lombardi discussed conservation with reference to the petroleum and natural-gas producers, and Warren Olney, Jr., presented general views upon the subject.

MARKET AND FINANCIAL NEWS

Financing a Mining Property

By Kirby Thomas
Consulting Mining Engineer, New York

THE owner of a mining property who is considering plans for financing his holdings by the sale of stock through brokers, or otherwise, should not only have competent legal advice, but he should consult with responsible brokers and with others experienced in the business phases of the mining business.

Certain states are favored for the incorporation of mining companies by brokers, by other financing agencies, and the public because their laws are suitable and favorable, and because they provide protection for the stockholders. The question of fees, miscellaneous charges, and taxes must also be taken into consideration as well as the desirability of exemption of the stockholder from company liability. Some markets and localities have sentimental, or other, preferences as to the state of incorporation. To incorporate in the state in which the property is located is not necessary, and generally such procedure is not considered advisable if those interested plan to sell the stock in other states. The extent to which the company may be controlled in its plans for financing by the "blue-sky" laws of the state of incorporation, or of the states in which the stock is to be sold, or of the state in which the property is located, is too complicated a question to discuss here, but it should be considered in deciding upon the state of incorporation and in the financing plans.

The name of the company is very important. General place names or the names of unknown individuals are not particularly helpful. Long or high-sounding names are detrimental. "Copy-cat" names are silly. A euphonious and distinctive name is best. In some cases it is desirable to have appended a place name, especially if the mine is in a locality well and favorably known.

The stock should have a par value of $1 or $10 per share, or no par value where it can be arranged without excessive fees and transfer stamp charges. Stocks having a value of less than $1 are commonly considered "cheap," and are undesirable for that reason. "Odd" par stocks are likely to be confusing to the buyer and to the broker. Generally the issue should be of common stock, as bond and preference stock have no real priority if the mine does not prove valuable, and if it does all the stock is made valuable to an extent which usually should be satisfactory to everyone concerned.

Bonds may be utilized for financing when the property is a proved producer and the proceeds are to be applied for a mill or equipment. Preference shares are applicable only to mines of limited potentiality, or in instances where the outstanding common stock is out of proportion to the expected profits. If the stock is to be listed on an exchange only common stock is the most desirable form of issue.

The company should own the property outright, where practicable, for legal and other agencies supervising the sale of stocks in most states frown upon the public sale of stock in a company which has only a bond and lease, a lease, or a contract for its property, although this condition is legal, and is frequently accepted in the mining states. Most stock exchanges require that the company shall have record title to its property or to part of it. A mortgage payable at a fixed date reasonably remote is not considered objectionable.

The brokers and the present-day buyers of mining stocks prefer, and usually demand, fully paid and non-assessable stocks. This is stated as a condition without prejudice to the opinion that there is merit in assessable stocks.

Preparing the Records

Any responsible broker will require certified copies of the essential corporation records and attested evidences of legal title before commitment to any financing plan. A financial statement prepared by an accountant, signed by an officer of the company, and an up-to-date list of the stockholders also are necessary records in negotiations for the sale of the company's stock. Reports by reputable engineers on the company's property are necessary, and usually general data from the geological survey reports and general information covering the physical and economic phases of the property should accompany these reports. Maps and photographs are also helpful to supplement the reports and records. As a general rule, samples of the ore should not be submitted, as they mean nothing.

The owners' shares should be escrowed (pooled) so as not to come into the market in competition with the treasury stock during the financing. This should be done in a legal way, as "gentlemen's agreements" regarding sales of stock are often ineffective. If the owner requires some money during the financing operation, part of his stock can be made available for sale (distribution) as the treasury stock sale permits.

Rôle of Broker or Distributor

In polite parlance the present-day broker does not "sell stocks"—he "distributes securities." Be that as it may, the mine owner, after having incorporated his company, seeks some agency or means to exchange the company's shares for money, to provide finances for the proposed development and operations. Generally it is not practicable for the mining company to sell its stock direct by advertising and direct mail campaigns, or by direct solicitation by its officers or representatives. One reason for this is that most mining men and nearly all mining engineers are notoriously ineffective in the art of selling. The usual procedure at this stage is to bring in the promoter and through him enter into negotiations with brokers, though frequently the mining company representatives can satisfactorily establish direct relations with the stock-distributing agency.

The broker is nothing more or less than a highly specialized and energized merchant. He buys at as low a price as he can and sells at a profit. He prefers good goods (stocks), but he is more particularly concerned in the salability of his merchandise. He demands suitable terms, concessions, and support, and limits his contractual agreements as much as he can. The broker must have a large margin of profit because his overhead and general expenses are large, and in addition he must pay large commissions to salesmen. Usually the broker selling a mining stock for a new company will require at least a 50 per cent margin between cost and selling price. This seems excessive, but it is not much more than is paid for the sale of many of the stocks of industrial and commercial companies in their development stage.

This margin of profit to the broker may be arranged in several direct or indirect ways. The company may sell or option its stock at a fixed price, or a graded fixed price, to the broker, who sells it at whatever price he can obtain; or the company may allow the broker a fixed percentage of the selling price of its stock for expenses and commission. In many states this commission is fixed by law at a maximum of 20 per cent or 25 per cent. To comply with this legal requirement and to meet the demands of the broker, various methods are resorted to which comply at least with

the letter of the law. Frequently the broker is given a "bonus," from the owners' stock, or an option at a low price on some of the owners' stock, on a pre-determined ratio with company stock sales. In any event, the company must expect to pay well for the sale of its stock through brokers.

The broker may sell through advertising and by mail solicitation or through stock salesmen. In either event the company is necessarily concerned in the method and manner of making the sales and in the representations made to the buyers of its stock, for there is always a responsibility on the company, often very direct. The broker may, and usually will, agree to confine his sales arguments to the facts as submitted by the company, but the salesmen, often of the "high-pressure" type, are not so easily controlled in their representations. These are difficulties inherent in all merchandising endeavors and must be met as best they can, as they arise. The general reputation of the broker is the best guide and safeguard available to the company in this respect—but there are brokers and brokers.

Listed and Unlisted Stocks

The purpose of listing a mining stock is to secure an open market and regular price quotations for the shares for the benefit of the shareholders. A shareholder often may want to sell, even at a lower price than he paid for his stock, for personal financial reasons, or he may favor taking a profit as the stock advances as a matter of personal policy. Listing enables this to be done easily and with certainty. Also, the published quotations are a comfort to the shareholders, especially if the stock is increasing in market price, and a very definite encouragement to them to hold their stock and buy more, either from the company's broker or in the market.

Distribution of a listed stock is not, however, as simple a matter as it may seem. The market must be supported by company purchases, or by the company's broker, in taking up offerings which might depress quotations below the selling price which the broker must obtain to meet his contract and make a profit. This requires a considerable reserve of capital, ever ready for the needs which the market may develop. Then the stock which has been repurchased in the market must be sold by the broker. The double commissions and the selling costs are a direct and large expense. Salesmen protected by liberal commission agreements are often tempted to "scalp" the market by indirect and generally untraceable transactions for their own account and benefit.

The difficulties of financing a mining company for development through the listed markets are such that the plans should not be undertaken except by those experienced in this business and gifted with real courage and genius for the task, and in addition supplied with ample capital for the marketing operations. And even then the result is generally disastrous to the mining company and unsatisfactory to the buyers of the stock, because the ordinary course of development of a mine cannot keep pace with the needs and ideas of the "market maker."

In general, it is desirable not to list a mining stock during the distribution period of the financing operation. This is especially true of prospects and of unproved mining properties, and it generally applies to financing of proved mines for equipment or operating capital.

As a general practice, the company will defer listing until its financing is completed, or well under way, and will meet the desires of the prospective buyers by an announcement that application to list will be made at a stated stage in the company's financing operations.

Underwritings, Options, and Syndicates

Usually the broker or stock distributor will not make a firm commitment to buy the stock of the mining company seeking capital. He takes an option to purchase, with a provision that the option contract shall lapse if a minimum average number of shares is not purchased by him each month. This is, of course, a one-sided arrangement and involves a large measure of risk and disadvantage to the mining company, for if the broker offers a stock and fails, the issue is more or less discredited for subsequent negotiations. More serious than complete failure is the limited performance of the broker, which leaves the company with a small part of its stock out and wholly insufficient capital to undertake mining development or operation. This stock is likely to be freely offered for sale by the disillusioned or discouraged buyers, at low prices, to the detriment of any subsequent financial program. All who seek to finance through option contracts with brokers should be aware that some of the less responsible brokers may take on an issue without any expectation, or real intention, of seeing it through, but for the sole purpose of obtaining the profits from the "quick" sales which can be made to the old stockholders (reloading), or to the friends of the officers and stockholders. Frequently, the broker will sell only the low-priced stock, thus securing the greatest profit to himself and the least return to the company.

An underwriting of the stocks by a broker or syndicate is a very different matter from the usual option contract. If the underwriter is responsible, the company's financing is assured to the amount of the commitment. In this case the broker must provide the payments whether sales are made or not. Generally, brokers who will undertake an underwriting have control of sufficient capital to meet the earlier payments, and the sale of the stock to the public is deferred until the mine developments have progressed to a stage which will insure the sale of the stock at a good profit.

Syndicate underwriting is more common. The broker may participate in the syndicate and the individual parties interested in the mining company may also do so. The syndicate makes an intermediate profit, which may be considerable, as compensation for the responsibility involved. Syndicate underwriting is coming into favor and is a desirable procedure when its application is practicable.

Conclusion—the Moral

This brief summary has touched only the high spots of procedure in the sale of mining stocks through brokers. These statements and inferences may deter some and may spur others to follow the same old trails in their search for capital for mining. However, in any event, the securing of capital by the sale of stock is a difficult task and one that should not be undertaken by the inexperienced or the uninitiated. The moral is obvious—that the man or company proposing to raise necessary capital through the sale of stock by brokers or on the listed markets should have the advice and guidance of someone experienced in the ways and byways of the business and in whom faith and confidence may be reposed.

Anaconda Doubles Shares

DIRECTORS of Anaconda Copper Mining Company on Jan. 22, 1929, recommended to shareholders an increase in the company's capital stock from 6,000,000 to 12,000,000 of par value of $50 per share. Of the 6,000,000 shares authorized under the present capitalization, 3,302,817 are outstanding. The purpose in increasing the authorized number of shares is to provide for future expansion plans. Anaconda shareholders will vote on the proposal at a special meeting to be held March 14.

Anaconda directors voted, also, to offer 73 shares of Anaconda for 100 shares of Chile Copper Company common stock. The offer will expire at 3 p.m., April 30, 1929. Anaconda already owns more than 51 per cent, probably not far from 60 per cent, of the 4,415,498 shares of Chile Copper stock outstanding.

At a meeting of the directors of the Chile Copper Company, likewise on Jan. 22, 1929, an increase in the company's quarterly dividend rate from 75c. to 87½c. per share was announced. The first dividend at the higher rate is to be paid April 22, 1929; the last dividend at the old rate was paid Dec. 29, 1928, which means that no dividend payment will be made on Chile stock during the first quarter of 1929. However, it seems likely that the April payment announced is in reality the first quarter payment, held up temporarily pending the conversion of the minority stock into Anaconda shares, and that another payment at the same rate will be made later on during the second quarter. Of course, a complete conversion of Chile shares into Anaconda stock would do away with the necessity of continuing Chile dividends as such.

Concentrate Sales Agency Plan Adopted by Tri-State Operators

A SELLING agency in the Joplin-Miami district for the disposal of zinc concentrates was established on Jan. 24. The plan has been under consideration for more than a year, but it has been only within the last two months that a concerted drive has been made by its backers to put it over.

R. C. Allen, of Cleveland, Ohio, representing Ogleby, Norton & Company, and backed by a number of operators, succeeded in getting operators to sign a contract, which is to run for three years. Fourteen of the 65 companies in the district have contracted with the agency. Mr. Allen claims these 14 companies have a potential production of about 300,000 tons of zinc concentrate a year, which is about 45 per cent of the anticipated production for 1929. The contract, as stated, runs for a period of three years, beginning Feb. 1.

Mr. Allen makes no impossible claims for the sales agency idea, but believes that savings can be made which will more than offset the cost. However, considerable opposition was encountered. Its opponents assert that it will not decrease buying costs, but actually will add to the selling cost of their product. They further assert that the present buying costs of smelter are about 25c. per ton of concentrates, whereas the new plan, on a $40 settlement price basis, would involve 30c. per ton of concentrates. Under the present plan the cost of purchases decrease as the tonnage involved increases, whereas under the agency plan the cost decreases only when the price declines.

Even when the agency is placed in operation, it is expected that smelters will continue to buy concentrates by the old method and utilize the offerings of the agency only when absolutely necessary. The plan also provides that the operator has the privilege of disposing of his own ore, provided that he pay the agency its commission anyhow. Some of the signers have probably become such as a matter of policy, and will continue to sell their own output even if the agency comes into being.

Wright-Hargreaves Passes Dividend

AT THE recent meeting of the directors of the Wright-Hargreaves, the regular quarterly dividend of 2½c. per share, which would have been paid in February, was passed. The action was not unexpected, as the company has not been earning sufficient to meet the dividend requirements. No action was taken regarding the operation of the mill, and no decision is expected until the report of the independent engineer who has made an examination of the property has been received. This report may advise a substantial cut in mill tonnage, and the company may have to operate at a loss for a time until development work has caught up.

January Dividend Total Highest on Record

DIVIDEND payments by American mining companies during January, 1929, totaled $25,603,109, a new record for the month. Resumption of dividends by Inspiration Consolidated aided materially in swelling the total, as did increased rates of payments by Cleveland-Cliffs Iron, Copper Range, Kennecott, Magma, North Lily, Phelps Dodge, and New York & Honduras Rosario.

Companies which made smaller payments than in January, 1928, or which have dropped from the group during the past year include Cresson Consolidated, Tintic Standard, United Gold Mines, Virginia Iron, Coal & Coke, Hollinger, Lucky Tiger-Combination, Patiño Mines & Enterprises, Premier Gold, San Francisco Mines of Mexico, and Santa Gertrudis.

Continued improvement in dividend payments by copper-mining companies remains a feature of the dividend situation, though the tenacity with which lead-zinc and complex-ore producers, as a group, are clinging to dividend rates established during periods of higher metal price indicates that numerous operating economies must have been effected throughout the industry during this period of readjustment.

E.&M.J. Compilation of Mining Dividends and Yields for January, 1929

Companies in the United States	Situation	Per Share	Total	Per Cent Annual Yield
Aluminum Co. of America, pfd	Various	$1.50 Q	$2,214,930	5.9j
Arizona Commercial, c	Ariz.	0.25SA	66,250	5.1j
Bethlehem Steel, pfd	Various	1.75 Q	1,679,500	....
Bunker Hill & Sullivan, l,s,z	Idaho	0.75 MX	243,250	6.2
Bunker Hill & Sullivan, pfd	Idaho	2.25 Q	16,458	....
Cleveland-Cliffs Iron	Mich.	2.00 QX	800,000	2.9j
Consolidated Lead & Zinc	Okla., Kans.	0.25 Q	50,000	4.8j
Copper Range	Mich.	0.50	197,347	5.8j
Cresson Consolidated Gold	Colo., Mo.	0.02 Q	24,400	19.2j
Eagle-Picher Lead, pfd., l,z	Okla., Mo.	1.50 Q	12,769	5.5
Homestake Mining, g	S. D.	1.50 MX	376,740	9.3j
Evans Wallower, pfd., l,z	Various	1.75	21,875	....
Inland Steel, pfd	Minn.	1.75 Q	175,000	....
Kennecott Copper	Alaska	2.00 Q	9,032,326	3.9j
Magma Copper, c,s	Ariz.	1.00 Q	408,155	4.8j
Newmont Mining, h	Various	1.00 Q	478,308	2.1
Inspiration Consol., c	Ariz.	0.75 R	886,476	....
Nichols Copper, "A"	N. Y.	0.4375 Q	40,247	....
North Lily, s,l	Utah	0.25 Q	198,888	5.6j
Park Utah Consolidated, s,l,z	Utah	0.20 Q	418,700	6.9
Phelps Dodge, c	Various	2.50 Q	1,250,000	3.8j
Republic Iron & Steel, pfd	Various	1.75 Q	437,500	....
Silver King Coalition, s,l	Utah	0.25 Q	304,502	8.5j
Sloss Sheffield Steel & Iron, pfd	Ala.	1.75 Q	117,250	6.2
Tintic Standard, l,s	Utah	0.20 X	230,583	9.1j
U. S. Smelting, Refining & Mining, s,l	Various	0.875 Q	499,242	5.5
U. S. Smelting, Refining & Mining, pfd	Various	0.875 Q	425,556	6.7
Companies in other countries:				
Asbestos Corporation, pfd	Quebec	1.75 Q	130,482	11.3
Consolidated M. & S., l,z,s	B. C.	6.25 SAB	3,178,481	3.3
Dome Mines, g	Ont.	0.25 Q	238,333	10.4
Greene Cananea Copper	Sonora	1.00 Q	500,000	1.7j
Hollinger Consolidated Gold	Ont.	0.05 FW	246,000	11.7j
Howe Sound, s,c,l	B. C., Mex.	1.00 Q	496,038	5.8
Nipissing, s	Ont.	0.075 Q	90,000	8.4
Premier Gold, s,g	B. C.	0.06 Q	300,000	11.5j
N. Y. & Honduras Rosario, g,s	Honduras	0.50 QX	100,000	....
Total			$25,603,109	

s, silver; l, lead; z, zinc; g, gold; c, copper; h, holding; Q, quarterly; M, monthly; X, extra; FW, four weeks; QX, $0.25 regular and $0.25 extra; $1 regular and $1 extra; SA, semi-annually; SAB, semi-annual; $1.25, bonus $5; MX, monthly 25c., extra 50c.; R, resumption; j, based on dividends for the last twelve months.

Noranda Offers Additional Stock

NORANDA MINES, LTD., offers shareholders rights to subscribe to additional stock in ratio of one new share at $45 for each 30 shares held. Proceeds will be used to retire outstanding 7 per cent bonds of company's wholly owned subsidiary, Horne Copper Corporation, and to capitalize the $1,500,000 expenditure on the doubling of the plant capacity and extension of underground work.

"This financing will enable company to pay dividends to stockholders much sooner than otherwise would be possible," states J. Y. Murdock, president.

Stockholders at annual meeting, to be called in next few weeks, will be asked to increase authorized stock in order to make this offering possible.

As of Dec. 31, 1928, there were 2,168,566 shares of no-par capital stock outstanding. Out of an original issue of $3,000,000 7 per cent first mortgage sinking fund bonds, due Jan. 1, 1937, of Horne Copper Corporation, a wholly owned subsidiary of Noranda, there is $2,450,000 outstanding, all held by Hollinger Consolidated Gold Mines, Ltd. Retirement of the bonds will lift the sinking fund requirements of $2 a ton mined.

TENNESSEE COPPER AND CHEMICAL CORPORATION has called a special meeting of stockholders for Feb. 4 to authorize creation of $5,000,000 convertible 6 per cent debenture gold bonds, of which it is proposed to issue at present between $3,000,000 and $3,500,000, according to Dow-Jones. The remainder will be issued at discretion of board. Proceeds will be used to make improvements at various plants of the company and its subsidiaries, to reduce costs and diversify the company's business.

Survey of World Zinc Conditions

By International Metal Service, London
Foreign Correspondent of American Zinc Institute, New York

DISAPPOINTING as was the course of the zinc market throughout the greater part of 1928, a more confident tone prevailed in the closing weeks. The new year opens, therefore, under much happier auspices, in the belief that the international cartel will justify itself. Its scope is perhaps limited as at present constituted, but, if it makes a success of its operations in the first six months of this year, there is no reason why its objective should not be broadened so as to enable it to become as powerful a force in the world zinc situation as is Copper Exporters, Inc., in copper. Given a successful handling of the position by the present organization, no reason is apparent why American zinc interests would refuse to become more intimately connected with the association in order to permit it to become a more potent factor in controlling output and selling price. Having regard to the influence of the London market on the selling price at East St. Louis, the American zinc industry has much to gain by the success of the international cartel.

Prospects for 1929 are bright. A tendency to increase production is evident, now that the London price has improved to within a few shillings of £27. Consequently, the cartel will need to be watchful to prevent overproduction. If success in that direction is attained, there is, of course, no reason why the price should not be advanced a stage higher in the second half of the year, if not earlier. In any event the average selling price for 1929 should be appreciably higher than the £25 5s. 5d. average of 1928. That it will equal the £28 9s. 11d. average of 1927 is uncertain, but even £1 less than that figure—say £27 10s. 0d. per ton—would prove acceptable to the bulk of the European interests.

The past year has been conspicuous for further expansion of the electrolytic method of treatment and a lack of technical progress in the distillation process. Various electrolytic plants have been erected, and are in course of construction, in several countries; and, as regards the older process, beyond some unimportant additions to existing works, no entirely new plants have been erected, nor are any planned, to our knowledge. No new metallurgical features have been forthcoming, apart from a noticeable improvement in the recoveries at the leading electrolytic works of zinc and especially of byproducts from the ores treated.

No additional new processes have been reported, and of the three it is customary for us to mention at this time of the year there is little fresh to chronicle. A few more Waelz plants have been laid down for the production of oxide from residues, middlings, scrap, and ores. The Coley process has been in operation throughout the year in the trial plant of Stewarts & Lloyds at Halsowen, near Birmingham. In the judgment of its financial backers the process is a complete success and has reached the stage when it can be commercialized. Accordingly, a public company is being formed in London to acquire the world rights to issue licenses for the operation of the process, and possibly to work a plant itself. At the time of writing, we have not seen the prospectus of the new company, but preliminary publicity claims that the Coley method will represent a direct saving of £5 a ton in the cost of producing zinc. After the expenditure of a large sum of money, the important interests trying out the Ashcroft process abandoned their option. From what we hear, one difficulty of a mechanical nature arose which proved insurmountable. The inventor, however, claims that he has now overcome this one stumbling block to success, and, if this be so, it is not improbable that the rights may be optioned by another zinc group during the present year. The recoveries of zinc and byproducts by the Ashcroft process are so extraordinarily high that no one would wish matters to be left where they are now, without the process being definitely proved one way or the other.

We estimate world stocks of zinc at Jan. 1, 1929, as follows:

	Metric Tons
United States	41,200
Canada, including afloat	4,600
Germany-Poland	6,700
Belgium	6,400
France	800
Great Britain	1,800
Other Europe	1,200
Australia, including afloat	6,200
Far East	800
Elsewhere	2,000
Total	71,700

International Nickel Company of Canada, Ltd., shareholders on Jan. 3 approved the issue of 3,750,000 new shares of 7 per cent preferred stock with a par value of $5 a share. The new issue will be used to carry out a part of the exchange of stock called for by the International-Mond merger arrangements. One share of International Nickel common will be exchanged for one common share of Mond and one share of Nickel preferred stock (new) for one share of Mond preferred of £1 par value. A cash payment of 2s. 6d. will be made for Mond's 1st 7 per cent cumulative preferred stock. The time for deposit of the Mond shares expires on Jan. 18.

Anaconda Copper Mining Company has called for redemption Feb. 1 $598,000 first consolidated mortgage series A sinking fund 6 per cent gold bonds, due Feb. 1, 1953, at 105 and interest. Payment will be made at the Guaranty Trust Company, trustee, 140 Broadway, New York City.

A. S. & R. Acquires Large Interest in Rhodesian Copper Property

DIRECTORS of the American Smelting & Refining Company have announced the acquisition of a substantial interest in the N'Changa Copper Mines, Ltd., with holdings in Northern Rhodesia not far from the Bwana M'Kubwa, Roan Antelope, and N'Kana properties. The management of the N'Changa company will be relinquished by Minerals Separation, Ltd., in favor of A. S. & R. H. A. Guess, of the American company, has been elected to N'Changa's board of directors.

The present authorized capital of N'Changa is 600,000 shares of £1 par. N'Changa's authorized capital is to be increased to 3,000,000 shares of £1 each. Of the 2,400,000 new shares, 125,000 will be allotted fully paid to Rhodesian Congo Border Concession, Ltd., for prospecting rights over an additional 30,000 acres containing the extension of the N'Changa ore deposit, 75,000 shares will be offered to N'Changa stockholders, and 118,750 taken up by A. S. & R. Company for cash at 35s a share.

N'Changa stockholders will be given option on 225,000 shares and American Smelting & Refining Company stockholders will be given option on 356,250 shares for six months at the same price, the remaining 1,500,000 shares to be issued within two years at £2 a share, 60 per cent of these being destined for A. S. & R. ownership. Financing plan as outlined will, when completed, have supplied N'Changa over $21,000,000 additional working capital.

Kennecott Stock Split-Up

At a recent meeting of the directors of the Kennecott Copper Corporation a recommendation was presented to increase the number of shares of stock from 5,000,000 to 12,000,000 and to offer two shares of new stock for one share of old. A total of 4,551,015 shares of the old stock is outstanding.

Seneca Copper Mining Company has been authorized by the New York Stock Exchange to list 100,000 shares of capital stock without par value which has been sold and underwritten at a price of $3.75 per share, on official notice of issuance and payment in full, and 80,000 shares of capital stock for the payment of bond interest on the basis of $3.75 per share, on official notice of issuance, making the total amount applied for 730,000 shares.

New Jersey Zinc Company directors recently voted to recommend to stockholders the change in par value of the company's shares from $100 to $25, an exchange of four new shares for every share of $100 par held. Stockholders will act on the proposal at the annual meeting on Feb. 27. Stock transfer books will be closed from the close of business Feb. 7 until the opening of business Feb. 28.

The Market Report

Better Demand for Zinc Features Metal Markets

New York, Jan. 30, 1929—Both galvanizers and brass manufacturers took more interest in zinc this week, with the result that sales were the largest that they have been in two months. Copper was neglected, though the price remains firm. Lead was active. Tin and silver have been quiet with but little change in prices, and the minor metals have been featureless. The stock market has been somewhat reactionary, especially with regard to most of the mining issues. Continued excellent industrial conditions during the first half year seem assured, and optimism pervades the metal markets.

Daily Prices of Metals

Jan.	Electrolytic Copper	Straits Tin	Lead		Zinc
	Refinery	New York	New York	St. Louis	St. Louis
24	16.775	49.00	6.65	6.475@6.525	6.35
25	16.775	48.875	6.65	6.475@6.50	6.325@6.35
26	16.775	48.875	6.65	6.475@6.50	6.35
28	16.775	48.75	6.65	6.50 @6.525	6.35
29	16.775	48.625	6.65	6.50	6.35
30	16.775	48.625	6.65	6.50	6.35
	16.775	48.792	6.650	6.498	6.348

Average prices for calendar week ending Jan. 26, 1929, are: Copper, 16.700; Straits tin, 48.917; N. Y. lead, 6.650; St. Louis lead, 6.490; zinc, 6.348; and silver, 56.688.

The above quotations are our appraisal of the major markets for domestic consumption based on sales reported by producers and agencies. They are reduced to the basis of cash, New York or St. Louis, as noted. All prices are in cents per pound.

Copper, lead, and zinc quotations are based on sales for both prompt and future deliveries; tin quotations are for prompt delivery only.

In the trade, copper prices usually are quoted on a delivered basis; that is, delivered at consumer's plant. As delivery and interest charges vary with the destination, the figures shown above are net prices at refineries on the Atlantic seaboard. Delivered prices in New England average 0.225c. per pound above those quoted.

Quotations for copper are for the ordinary form of wire bars and ingot bars. For ingots an extra 0.05c. per pound is charged; for slabs, 0.075c.; and for cakes, 0.125c. up, depending on weight. Cathodes are sold at a discount of 0.125c. per pound.

Quotations for zinc are for ordinary Prime Western brands. Zinc in New York is now quoted at 0.35c. per pound above St. Louis, this being the freight rate between the two points.

Quotations for lead reflect prices obtained for common lead, and do not include grades on which a premium is asked.

London

Jan.	Copper			Tin		Lead		Zinc	
	Standard		Electrolytic	Spot	3M	Spot	3M	Spot	3M
	Spot	3M							
24	76 5/16	74 3/8	79 1/2	221 7/8	221 7/8	22 3/16	22 5/16	26 1/4	26 3/16
25	76 3/4	74 1/2	79 1/2	222 1/2	222 1/2	22 1/16	22 3/16	26 3/16	26 1/4
28	77 1/16	74 7/16	79 1/2	221 1/2	222	22 1/4	22 5/16	26 3/8	26 3/8
29	77 1/8	74 5/8	79 1/2	220 1/4	221 1/4	22 1/4	22 3/16	26	26
30	77 5/16	74 3/4	79 1/2	220 3/8	221 1/8	22 1/4	22 3/16	26 1/8	26 1/4

The above table gives the closing quotations on the London Metal Exchange. All prices in pounds sterling per ton of 2,240 lb.

Silver, Gold, and Sterling Exchange

Jan.	Sterling Exchange "Checks"	Silver		Gold London	Jan.	Sterling Exchange "Checks"	Silver		Gold London
		New York	London				New York	London	
24	4.84 9/16	56 1/2	26	84s11 1/2d	28	4.84 9/16	56 3/8	26 1/8	84s11 1/2d
25	4.84 1/2	56 3/8	26 1/8	84s11 1/2d	29	4.84 9/16	56 1/4	26 3/16	84s11 1/2d
26	4.84 7/16	56 3/8	26 1/16	.....	30	4.84 1/2	56 1/4	26 1/4	84s11 1/2d

Average, 56.729

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London silver quotations are in pence per troy ounce of sterling silver, 925 fine. Sterling quotations represent the demand market in the forenoon. Cables command three-eighths cent premium.

Copper Firm at 17c.

Though only a few thousand tons of copper have been sold in the domestic market in the week ending today, the tonnage being approximately the same as that of two weeks ago, prices are well maintained at 17c. for Eastern deliveries, and 17⅛c. in the Middle West, and the trend still seems upward rather than downward. Copper is now two cents higher than when wages were last increased, and it is felt that a further increase may be in order, in which case an advance in copper prices might result. Brass mills have been the chief purchasers, their demand being largely for April shipment, though February, March, and May have been represented as well. Most consumers are now fairly well covered through April, but have yet to buy practically all of their May requirements.

The foreign demand for copper has been excellent, with the indications that 65,000 to 70,000 long tons will be sold in that market this month. Still more encouraging is the great increase in foreign shipments, which, in January, will exceed by about 16 per cent the average of corresponding shipments for the previous six months. Germany, which fell back in its takings during the Ruhr strike period, has now resumed its place as the leading European buyer, and the consignments to France have also registered a healthy increase. The foreign price continues at the 17.25c., c.i.f. level set a week ago today. European consumers are not as well provided for future requirements as are domestic manufacturers, so that an active export demand is expected to continue, even though the domestic market may be quiet for a time.

Lead Market More Active

Business in lead during the week ending today has been somewhat better than in the preceding two weeks. The week's total is well above average. London prices for spot lead continue to waver uncertainly over a relatively narrow range. A feature of the lead situation recently has been the marked demand for chemical and corroding grades. This condition has resulted in the leading producers of these grades finding it necessary to draw upon their reserve stocks in order to supply the demand. As a result of this situation at least one large producer has been unable to quote upon several inquiries received in the last few days.

Prompt or February delivery has been specified on most of the sales. In the East St. Louis market, some lead was sold at 6.475c. per pound for February as well as for spot positions. For March delivery, however, most sellers are asking a premium over the prevailing quotation of 6.50c. per pound, and several sales of March metal were reported on a premium basis. Corroding lead has been in exceptionally strong demand and white lead manufacturers, in general, apparently are looking for a very active year in 1929.

Zinc May Advance

The formation of an ore-selling agency in the Tri-State district is held accountable for the greatly increased interest in zinc this week. It is felt that this agency, to justify itself, must show some advance in ore prices, and that if this occurs an advance in slab zinc prices will result. Both galvanizers and brass mills have been in the market, with the result that the tonnage sold has been larger than that for any other week since the late-November early-December buying wave. Offerings by dealers at 6.325c. are apparently all cleaned up, though one producer was forced to meet this price last Friday. The general level of quotations has been 6.35c. Some upward revision of wages in the smelters may be necessary if zinc goes to 6½c.

Tin Somewhat Easier

There is little that is new to report about the tin market. The situation remains an artificial one, and, though prices are fractionally lower than a week ago, the strength of the dominant bull group in London does not appear to be weakening perceptibly. Statistical comparisons appearing in certain daily newspapers, claiming to show that consumption is exceeding production, are reported to have been inspired by agents of this group.

Silver Market Quiet But Steady

The silver market has been quiet for the last week, and prices have fluctuated within narrow limits. India has given moderate support to the market, and reports from abroad indicate that China has operated both ways. The undertone is steady.

Mexican Dollars (Old Mexican pesos): Jan. 24th, 42⅜c.; 25th, 43c.; 26th, 42⅜c.; 28th, 43c.; 29th and 30th, 43⅛c.

Foreign Exchange

Closing cable quotations on Tuesday, Jan. 29, 1929, were: Francs, 3.90⅛c.; marks, 23.75¼c.; lire, 5.23½c. Canadian dollars ¼ of 1 per cent discount.

Other Metals

Quotations cover large wholesale lots unless otherwise specified

ALUMINUM—Per lb., 99 per cent plus grades, price of leading interest, 24.30c. Outside market, 99 per cent plus, 24.30c.; 98-99 per cent, 23.90c.

ANTIMONY—Per lb., duty paid, New York: Chinese brands, 9⅝c. per lb. for spot; 9½c. per lb. for futures. Cookson's "C" grade, spot, 14¼c.

BISMUTH—Per lb., New York, in ton lots, $1.70. Smaller lots, $1.85 and up.

CADMIUM — Per lb., New York: 80@95c. Active demand.

IRIDIUM—Per oz., $260@$265 for 98 @99 per cent sponge and powder.

NICKEL—Per lb. ingot, 35c.; shot, 36c.; electrolytic, 35c. (99.9 per cent grade) for single lots of spot metal.

PALLADIUM — Per oz., $38@$40. Small lots bring up to $50. Nominal.

PLATINUM—Official price quoted by the leading interest on small miscellaneous orders for refined metal, per oz., $70. Transactions between dealers and refiners in the outside market are commonly reported at several dollars less.

QUICKSILVER — Per 76-lb. flask, $119 cash. Small lots command the usual premiums. Market quiet.

Prices of Cobalt, Germanium Oxide, Lithium, Magnesium, Molybdenum, Osmium, Radium, Rhodium, Ruthenium, Selenium, Tantalum, Tellurium, Thallium, Tungsten, and Zirconium are unchanged from the issue of Jan. 5.

Metallic Ores

TUNGSTEN ORE—Per unit of WO_3, N. Y.: wolframite, $11.75@$12; Western scheelite, $12@$12.50.

Chrome, Iron, Manganese, Tantalum, Titanium, Vanadium, and Zircon ores are unchanged from quotations in the Jan. 5 issue.

Price of Lead Concentrates Advanced

Joplin, Mo., Jan. 26, 1929.

Blende

	Per Ton
High	$43.35
Premium blende, basis 60 per cent zinc	$40.00@ 41.00
Prime Western, basis 60 per per cent zinc	39.00@ 40.00
Fines and slimes	36.00@ 38.00
Average settling price, all zinc	40.43

Galena

High	$90.40
Basis 80 per cent lead	$87.50@ 90.00
Average settling price, all lead	88.78

Shipments for the week: blende, 12,669; lead, 1,024 tons. Value, all ores the week, $603,080.

Shipments for the month: blende, 46,330; lead, 5,749 tons. Value, all ores the month, $2,332,770.

A basis of $90 was paid in settlement for at least one lot of lead concentrate this week. Other buyers report offerings on a $87.50 basis. The drop of more than 600 tons in the shipment indicates that sellers are awaiting higher prices.

The zinc ore shipment total for January, 1929, was 9,140 tons more than the same month last year, an average increase of 2,285 tons per week, while production was increased an average of only 895 tons per week. The reserve stock of zinc concentrates is approximately 14,000 tons less than it was at this time in 1928.

Platteville, Wis., Jan. 26, 1929

Zinc Blende	Per Ton
Blende, basis 60 per cent	$42.75
Lead Ore	
Lead, basis 80 per cent	$87.00

Shipments for the week: Blende, 313 tons; lead, none. Shipments for the year: Blende, 2,381 tons; lead, 40 tons. Shipments for the week to separating plants, 1,257 tons blende.

Non-Metallic Minerals

Amblygonite, Asbestos, Barytes, Bauxite, Borax, Celestite, Chalk, China Clay, Diatomite, Emery, Feldspar, Fluorspar, Fuller's Earth, Garnet, Gilsonite, Graphite, Greensand, Gypsum, Iron Oxide, Lepidolite, Limestone, Magnesite, Mica, Monazite, Ocher, Phosphate, Potash, Pumice, Pyrites, Quartz Rock Crystal, Silica, Spodumene, Sulphur, Talc, and Tripoli are unchanged from prices in the Jan. 5 issue.

Metallic Compounds

ARSENIOUS OXIDE (White Arsenic) Per lb., 4c. Market firm.

COPPER SULPHATE—Price advanced from 5.50 to 5.65c. per lb. in carload lots for large or small crystals, on Jan. 22.

Antimony Oxide, Calcium Molybdate, Sodium Sulphate (Salt Cake), Sodium Nitrate, and Zinc Oxide are unchanged from prices in the Jan. 5 issue.

Alloys

FERROMANGANESE—Per long ton, domestic and foreign, f.o.b. furnace or duty paid, port of entry, $105. Spiegeleisen, 19@21 per cent, $33@$34 f.o.b. furnace.

FERROTUNGSTEN—Per lb. of W contained, 75@80 per cent W, $1.04@$1.10.

NICKEL SILVER—32c. per lb. for 18 per cent Grade A sheets.

YELLOW (MUNTZ) METAL—Dimension sheets, 22½c. per lb.; rods, 19½c. per lb.

Ferrocerium, Ferrochrome, Ferromolybdenum, Ferrophosphorus, Ferrosilicon, Ferrotitanium, and Ferrovanadium are unchanged from prices in the Jan. 5 issue.

Rolled Metals

COPPER—Sheets, hot rolled, 26½c. per lb.; for wire, 18⅞c. per lb.

LEAD SHEETS—Full-rolled sheets 10½c. per lb.; clipped sheets 10¾c. per lb.

Monel Metal, Nickel, and Zinc Sheets are unchanged from prices in the Jan. 5 issue.

Refractories

Chrome Brick, Fireclay Brick, Magnesite Brick, Silica Brick and Zirkite are unchanged from quotations in the issue of Jan. 5.

Iron, Steel and Coke

Iron—Per gross ton, Valley furnaces, Bessemer, $18@$18.25; basic, $17.50; No. 2 foundry, $17.50@$18.

Steel—Base prices per gross ton, Pittsburgh, billets and slabs, $33; plates, structural shapes, and soft steel bars, per lb., 1.90@2c.

Coke—Per gross ton, Connellsville furnace, $2.75. Connellsville foundry, $3.75@$4.85. Byproduct coke, Ohio and Kentucky, $7; Buffalo and Detroit, $8.50@$9.

Mining Stocks—Week Ending Jan. 26, 1929

Stock	Exch.	High	Low	Last		Last Div.
COPPER						
Anaconda	New York	128⅛	123¼	123⅛	Ja. 2, Fe. 18	Q 1.50
Andes Copper	New York	52⅛	49⅛	50	No. 15, De. 17	I 0.75
Arizona Com	Boston	4½	4	4	Ja. 16, Ja. 31	S.A. 0.25
Calumet & Ariz	New York	127¼	123½	124⅛	De. 1, De. 17	QX 2.50
Calumet & Hecla	Boston	57	48⅛	54	Fe. 28, Ma. 30	Q 1.00
Cerro de Pasco	New York	105⅛	103¼	104½	Ja. 11, Fe. 1	Q 1.25
Chile Copper	New York	92⅛	86⅛	89⅛	Ma.22, Ap.22	Q 0.87½
Con. Coppermines	N. Y. Curb	15⅛	14⅛	15		
Copper Range	Boston	30	26	28⅛	De. 15, Ja. 15	Q 0.50
East Butte	Boston	3⅛	3¼	3⅛	Dec., 1919	0.50
Granby Con	New York	91⅛	88⅛	88⅛	Ja. 4, Fe. 1	Q 1.50
Greene Cananea	New York	183½	173½	175½	De. 1, Ja. 7	Q 1.50
Howe Sound	New York	71⅛	68⅛	68⅛	De. 31, Ja. 5	Q 1.00
Hudson Bay	N. Y. Curb	21⅛	20⅛	20⅛		
Inspiration	New York	47⅛	45⅞	46⅛	De. 20, Ja. 7	Q 0.75
Isle Royale	Boston	28	25	27⅛	Fe. 28, Ma. 30	0.50
Kennecott	New York	159½	152	154	No. 30, Ja. 2	Q 2.00
Magma Copper	New York	69⅛	67⅛	67⅛	De. 31, Ja. 15	Q 1.00
Mason Valley	N. Y. Curb	2	1	1⅞		
Miami Copper	New York	35	33⅛	33⅛	Fe. 1, Fe. 15	Q 0.50
Mohawk	Boston	48⅛	45⅛	45⅛	Ja. 26, Ma. 1	Q 1.50
Mother Lode	New York	3⅛	3⅛	3⅛	De. 14, De. 31	0.20
Nevada Con	New York	46⅛	43	45	De. 14, De. 31	Q 0.50
New Cornelia	N. Y. Curb	42⅛	41	41⅛	Fe. 1, Fe. 18	Q 0.50
Noranda	N. Y. Curb	68⅛	62⅛	62⅛		
Ohio Copper	N. Y. Curb	4⅛	2⅛	2⅛	Sept., 1926	0.03
Old Dominion	Boston	19½	18	18⅛	Dec., 1918	1.00
Phelps Dodge	N. Y. Curb	212	207⅛	210	De. 18, Ja. 2	Q 2.50
Quincy	Boston	49	45	48⅛	March, 1920	1.00
Roan Antelope	N. Y. Curb	50	45⅛	48		
St. Mary's M. L.	Boston	39⅛	34⅛	39	No. 20, De. 1	1.00
Seneca Copper	New York	6	5⅛	6		
Shattuck Denn	N. Y. Curb	23⅛	21⅛	22⅛		
Sherritt-Gordon	Toronto	7	5	7		
Tenn. C. & C.	New York	18⅛	17⅛	18	Au. 31, Se. 15	Q 0.25
United Verde Ex	N. Y. Curb	23	20⅛	22⅛	Ja. 4, Fe. 1	0.75
Utah Copper	New York	....	....	290	De. 14, De. 31	Q 3.00
Waite-Ack.-Mont	Toronto			2.35		
Walker Mining	Salt Lake	2.77½	2.65	2.70		
Wenden Copper	N. Y. Curb	2⅛	2	2⅛		
LEAD, ZINC, SILVER						
Ahumada Lead	New York	4⅛	3⅛	3⅛		
Amer. Z. L. & S	New York	42⅛	39⅛	41	May, 1917	1.00
A. Z. L. & S., pfd	New York	107½	105	105½	Nov., 1920	1.50
Bingham Mines	Boston	54⅛	53⅛	53⅛	De. 20, Ja. 5	Q 0.50
Bunker Hill & S	N. Y. Curb	....	....	145½	Oc. 31, No. 5	X 0.75
Butte Cop. & Zn	New York	9	8⅛	8⅛	De. 14, De. 31	Q 0.50
Butte Cop. Con	Boston Curb	1.00	*95	1.00		
Butte & Sup	New York	11⅛	10⅛	10⅛	Se. 14, Se. 29	Q 0.50
Callahan Zn-Ld	New York	4	3⅛	3⅛	Dec., 1920	0.50
Chief Consol	Salt Lake	†3.50	†3.45	3.50	Ja. 10, Fe. 1	K 0.10
Consol. Ld. & Zn. "A"	St. Louis	13⅞	11	13⅛	Ja. 1	0.25
Constitution	Spokane	....	....	*35½		
Dayrock	Spokane	....	....	1.60		
Dickens Consol	Spokane	....	....	*17½		
Duthie Mines	Spokane					
Eagle-Picher	Cincinnati	21⅛	20⅛	21⅛	No. 15, De. 1	Q 0.40
Eagle-Pich., pfd	Cincinnati	....	....	110	July 15	Q 1.50
Erupcion	Boston Curb	*29	*24	*29	Ja. 1, 1928	Q 0.07½
Eureka Bullion	Salt Lake					
Eureka Lily	Salt Lake	*61	*59	*61		
Eureka Standard	Salt Lake	5	5	5		
Evans-Wallower	N. Y. Curb	22	20⅛	20⅛		
Evans-Wal., pfd	N. Y. Curb	92	85	92		
Federal M. & S	New York	270	249	270	Je., 1927	10.00
Fed. M. & S., pfd	New York	100⅛	100	100⅛	No. 23, De. 15	Q 1.75
Gladstone	Spokane	....	....	*11½		
Golconda	Spokane	....	....	*20		
Grandview	Spokane			*81		
Hecla Mining	N. Y. Curb	17⅛	16⅛	17⅛	No. 13, De. 14	Q 0.15
Highland-Surprise	Spokane	....	....	*14		
Jack Waite	Spokane	....	....	*16½		
Kootenay Florence	Spokane	....	....	*27		
Lucky Jim	Spokane	....	....	*24		
Lucky Tiger-C	Kansas City	†6.35	†6.20		De. 4, De. 20	MX 0.8½
Mexican Premier	Spokane			*84½		
National Lead	New York	150½	146	148½	De. 14, De. 31	Q 1.25
Natl. Lead, pfd. A	New York	140½	140	140	Ma. 1, Ma. 15	Q 1.75
Natl. Lead, pfd. B	New York	118	118	118	Ja. 18, Fe. 1	Q 1.50
N. J. Zinc, new	N. Y. Curb	87⅛	75⅛	83⅛	Ja. 19, Fe. 9	X 2.00
New Quincy	Salt Lake	1.45	1.35	1.42½		
Noble Five	Spokane	....	....	*70		
North Lily	Salt Lake	8.00	7.90	7.95	Oct. 20	I 0.20
Park Bingham	Salt Lake	....	....	....		
Park Utah	New York	13⅛	11⅛	11⅛	De. 31, Ja. 2	Q 0.20
Pend Oreille	Spokane	....	....	*14		
Rico Argentine	Salt Lake	*46	*46	*46	No. 30, De. 15	Q 0.03
Ruth-Hope	Spokane	....	....	*61		
St. Joseph Lead	New York	94	82⅛	83⅞	Ma. 8, Ma. 20	QX 0.75
Sherman Lead	Spokane	....	....	*20		
Silver King Coa	Salt Lake	13.25	13.00	13.25	De. 15, Ja. 2	QX 0.35
Silversmith	Spokane	....	....	*12	Oct., 1926	Q 0.02
Sunshine Mining	Spokane	....	....	1.48	De. 20,	BM 0.02
Tamarack-Custer	Spokane	....	....	*33⅛	Sept., 1924	0.25
Tintic Standard	Salt Lake	14.60	14.00	14.37½	De. 23, Ja. 23	X 0.20
Tonopah Belmont	N. Y. Curb	1	1	1	Oct., 1925	0.05
Treadwell-Yukon	Toronto	12.00	11.50	11.50		
United Zinc Smg	N. Y. Curb	1⅛	1⅛	1⅛		
Utah Apex	Boston	4⅛	3⅛	4	Je. 14, Au. 1	K 0.25
Utah Met. & Tun	Boston	1⅛	*99	1⅛	Dec., 1917	0.30
Whitewater	Spokane	....	....	1.35		
Yellow Pine	Los Angeles	*19½	*15	*15	Dec., 1925	QX 0.04
GOLD						
Alaska Juneau	New York	9⅛	8⅛	8⅛		
Barry-Hollinger	Toronto	*32	*23	*32		
Central Manitoba	Toronto	*70	*66	*67		
Coniaurum	Toronto	2.25	2.05	2.25		
Cresson Consol	N. Y. Curb	1⅛	1⅛	1⅛	Oc. 15	Q 0.02
Dome Mines	New York	10⅛	9⅛	9⅛	De. 21, Ja. 21	Q 0.25
Golden Cycle	Col. Springs	†1.53	†1.51	.....	No. 30, De. 10	Q 0.04
Gold Hill	Toronto	*7	*5	*5⅛		
Hollinger	Toronto	10.00	8.95	9.20	De. 12, De. 31	M 0.05
Homestake	New York	74⅛	75⅛	76⅛	Ja. 19, Ja. 25	MX 1.50
Kirland Lake	Toronto	1.90	1.71	1.78		
Lake Shore	Toronto	21.50	19.00	20.00	De. 1, De. 15	QX 0.40
McIntyre-Poro	New York	22⅛	21	21	Fe. 1, Ma. 1	Q 0.25
Portland	Colo. Springs	†*10	†*9⅛	.....	April, 1927	0.02
Rand Mines	New York			37⅛	Au. 21, '28	Am.Sh. 1.52
Siscoe	Toronto	†1.60	†1.55			
Sylvanite	Toronto	2.10	2.03	2.05		
Teck-Hughes	Toronto	9.30	9.00	9.05	Ja. 31, Fe. 1	0.15
Tom Reed	Los Angeles	*20	*15	*15	Dec., 1926	0.02
Unity Gold	N. Y. Curb	1⅛	1⅛	1⅛		
Vipond Consol	Toronto	1.25	1.05	1.15	April, 1927	0.03
Wright-Hargreaves	Toronto	2.45	1.75	2.00	Oc. 16, No. 1	Q 0.02½
Yukon-Alaska	N. Y. Curb	34	33⅛	33⅛		
GOLD AND SILVER						
Carnegie Metals	N. Y. Curb	19⅛	19	19		
Castle-Trethewey	Toronto	*40	*40	*40		
Cent. American	N. Y. Curb					
Consol. Cortez	N. Y. Curb	*25	*20	*25		
Dolores Esperanza	N. Y. Curb	1⅛	*91	1⅛	July 1923	0.05
Keeley	Toronto	*62	*50	*61	Mh. 1, Mh. 15	SA 0.04
Mining Corp	Toronto	5.25	4.67	5.00	De. 14, De. 31	Q 0.15
Montana-Idaho	Spokane	*11⅛	*10⅛	*10⅛		
N. Y. & Hond. Ros	N. Y. Curb	16⅛	16⅛	16⅛	Ja. 16, Ja. 26	X 0.05
Nipissing	N. Y. Curb	3⅛	3⅛	3⅛	De. 21, Ja. 21	Q 0.07
Premier Gold	N. Y. Curb	2⅛	2⅛	2⅛	De. 14, Ja. 4	0.06
Tonopah Exten	N. Y. Curb	*39	*20	*20	April, 1925	0.05
Tonopah Mining	N. Y. Curb	4	3⅛	4	Se. 29, Oc. 20	SA 0.07½
United Eastern	N. Y. Curb	*89	*86	*89		
Yukon Gold	N. Y. Curb	1⅛	1	1	June, 1918	0.02
IRON AND STEEL						
Bethlehem Steel	New York	87⅛	83⅛	84⅛	Ap. 19, Ma. 15	1.00
Beth. Steel, pfd, 7%	New York	123	122½	122½	Ma. 4, Ap. 1	Q 1.75
Cleveland-Cliffs	Cleveland	145	140	142	Ja. 15, Ja. 25	QX 2.00
Colo. Fuel & Iron	New York	72⅛	69⅛	71⅛	Au. 10, Au. 25	Q 2.00
Colorado F. & I., pfd	New York	....	....	....		
Great Northern Iron	New York	37⅛	21	35⅛	Ap. 9, Ap. 30	K 0.75
Inland Steel	New York	89⅛	85	87⅛	No. 15, De. 1,	Q 0.62½
Republic I. & S	New York	86⅛	82½	83⅛	Fe. 13, Ma. 1,	Q 1.00
Republic I. & S., pfd	New York	112	112	112	Ma. 11, Ap. 1,	Q 1.75
Sloss-Sheffield S. & I	New York	....	....	125	De. 20, Ja. 2	Q 1.75
Sloss-Shef. S. & I., pfd.	New York			112	Se. 20, Oc. 1,	Q 1.75
U. S. Steel	New York	192⅛	182⅛	187⅛	No. 30, De. 29,	Q 1.75
U. S. Steel, pfd	New York	143⅛	141½	143⅛	No. 3, No. 28,	Q 1.75
Virginia I. C. & C	New York	....	....	25	Jan., 1924	1.50
Virginia I.C.& C., pfd.	New York	....	....	47⅛	Jl. 16, Jl. 2,	SA 2.50
MISCELLANEOUS						
Aluminum Co. of Am.	N. Y. Curb	189	166	175		
Alum.Co.of Amer., pf.	N. Y. Curb	105⅛	105⅛	105⅛	No. 20, De. 9,	Q 0.75
American Metal	New York	74	68⅛	71		
Amer. Metal, pfd., 6%	New York	125⅛	121⅛	124	No. 20, De. 1,	Q 1.50
Amer. Sm. & Ref	New York	114⅛	95	114⅛	Oc. 11, Oc. 11,	Q 2.00
Amer. Sm. & Ref., pfd.	New York	138	137	137⅛	Fe. 1, Ma. 1	Q 1.75
Amer.Sm.& Ref., new	New York			94⅛		
Ang. Ch. Nitrate	N. Y. Curb	45⅛	39	42⅛		
Asbestos Corp	Montreal	22⅛	17⅛	21	Jan. 1926	1.50
Asbestos Corp., pfd	Montreal	68	62⅛	65	De. 31, Ja. 15	Q 1.75
Consol. M. & S	Montreal	435	393	435	De.31, Ja.15,	SAX 6.25
De Beers Consol	New York	....	....	23	Ja. 19, Ja. 26,	0.48
Federated Metals	N. Y. Curb	36	35	35		
Freeport Texas	New York	54⅛	51⅛	52⅛	Ja. 15, Fe. 1	Q 1.00
Int. Nickel Can	New York	72⅛	63⅛	68	De. 13, De. 31	Q 0.75
Int. Nicke., pfd	New York	120	118	120	Ja. 18, Fe. 1	Q 1.75
Newmont	N. Y. Curb	198⅛	193⅛	195⅛	De. 28, Ja. 15	Q 1.00
Patiño M. & E	New York	37⅛	36⅛	36⅛	Aug. 1928	4s.
So. America G. & P	N. Y. Curb	3⅛	3	3⅛		
Texas Gulf Sulphur	New York	80⅛	76⅛	78	De. 1, De. 15	Q 1.00
U. S. Sm. R. & M	New York	78⅛	67⅛	68⅛	De. 31, Ja. 15	Q 0.87½
U. S. Sm. R. & M., pfd.	New York	56	55⅛	55⅛	De. 31, Ja. 15	Q 0.87½
Vanadium Corp	New York	....	....	110⅛	Fe. 1, Fe. 15	Q 0.75

Toronto Standard Stock Exchange, Toronto, courtesy Arthur E. Moysey & Co.; Salt Lake Stock Exchange, courtesy J. A. Hogle & Co. and Logan & Bryan, New York; Spokane Stock Exchange, courtesy Pohlman Investment Company.

*Cents per share. †Bid or asked. Q, Quarterly. A. Annually. SA, Semi-annually. M, Monthly. BM, Bimonthly. FW, four weeks. K, Irregular. I, Initial. X, Extra. The first data given is that of the closing of the books; the second that of the payment of the dividend.

LONDON QUOTATIONS—WEEK ENDED JANUARY 15, 1929

	High	Low	Last	Date	Amount
Alaska Mexican ($5)	13/9	11/3	12/6		
Alaska Treadwell (25)	41/3	37/6	40/—	Nov., 1926	4 (d)
Armayo Mines (25 frs.)	68/9	66/10½	67/6	Nov. 1928	5 (c)
Burma Corp (10 rupees)	20/9	18/7½	18/9	Feb., 1929	7* annas
Bwana M'Kubwa (5s)	18/—	16/—	16/10½		
Camp Bird (2s)	4/1½	3/9	4/—	April, 1928	16⅛
El Oro (£1)	6/—	5/1½	5/6	Nov., 1924	2½*
Frontino & Bolivia (£)	8/9	8/4½	8/9	July, 1928	3½
Mexican Corpn. (£1)	13/9	10/—	13/—		
Mexican Mines of El Oro (£1)	28/9	18/9	22/6	Dec., 1926	3½*
Mond Nickel	131/10½	112/6	123/9	Feb., 1929	18⅛
Mount Isa (£)	40/7½	36/—	36/10½		
N'Changa Copper Mining	58/1½	38/—	55/—		
Oroville Dredging (4s)	3/—	2/9½	3/—	Nov., 1928	31½
Rhodesian Congo Border (£1)	81/3	63/4	80/—		
St. John del Rey (£1)	12/—	11/6	11/9	Dec., 1928	2½
San Francisco Mines (10s)	34/3	32/—	32/9	Jan., 1929	25
Santa Gertridia (£1)	14/4½	12/9	13/—	Jan, 1928	7½
Selukwe (2s. 6d.)	9/—	7/3	8/—	April, 1927	6⅛
S. Amer. Copper (2s.)	3/—	2/6	2/7½	Nov. 1917	75
Tanganyika (£1)	65/7½	62/9	65/—	July, 1928	5
Union Miniere de Haut-Katanga (Brussels)	11,700	11,500	11,550	July, 1928	182.60

*Free of British income tax. †Swiss francs and plus 15 p. c. bonus. ‡Belgian frs. and free of taxation.